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DIAGRAMS

TO ILLUSTRATE THE

LECTURES

ON

CRYSTALLOGRAPHY,

DELIVERED AT THE

SCHOOL OF MINES OF COLUMBIA COLLEGE,

BY

THOS. EGLESTON, Jr.,
Professor of Mineralogy and Metallurgy.

158997

NEW YORK:
1866.

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INTRODUCTION.

The following Diagrams are intended to illustrate the Lectures on Crystallography delivered at the School of Mines. Many of the Drawings have been made for this collection, but free use has been made of all the published works on Crystallography.

T. E., Jr.

April, 1866.

SYSTEMS OF CRYSTALLIZATION.

NO.	SIMPLE FORMS.	AXES.
1	Cube and octahedron.	3 axes rectangular and equal.
2	Right prism with square base.	3 axes rectangular, 2 equal.
3	Right prism with rectangular or rhombic base.	3 axes rectangular and unequal.
4	Right rhomboidal and oblique rombic prisms.	3 axes unequal, 2 rectangular.
5	Oblique disymetric rhomboidal prism.	3 axes unequal, and unequally inclined.
6	Rhombohedron and hexagonal prism.	4 axes, 3 equal and equally inclined, 1 at right angles to the other three.

NAMES USED BY DIFFERENT AUTHORS.

NO.	NAUMANN.	MOHS.	WEISS & ROSE.	PHILLIPS.	DELAFOSSE.	DANA.
1	Tesseral.	Tessular.	Regular.	Cubic.	Cubic.	Monometric.
2	Tetragonal.	Pyramidal.	2 and 1 axial.	Pyramidal.	Tetragonal.	Dimetric.
3	Rhombic.	Orthotype.	1 and 1 axial.	Prismatic.	Orthorhombic.	Trimetric.
4	Monoclinohedric.	Hemiorthotype.	2 and 1 membered.	Oblique.	Clinorhombic.	Monoclinic.
5	Triclinohedric.	Anorthotype.	2 and 1 membered.	Anorthic.	Clinohedric.	Triclinic.
6	Hexagonal.	Rhombohedral.	3 and 1 axial.	Rhombohedral.	Hexagonal.	Hexagonal.

MONOMETRIC SYSTEM.

HOLOHEDRAL FORMS.

CUBE.

1. Cube or Hexahedron.
2. Cube with rhombic Dodecahedron.
3. Rhombic Dodecahedron and Cube.
4. Rhombic Dodecahedron.
5. Cube and Tetrahexahedron.
6. Tetrahexahedron and Cube.
7. Tetrahexahedron.
8. Cube and Octahedron,
9. Cubo-Octahedron.
10. Octahedron.
11. Cube and Tetragonal-Trisoctahedron.
12. Tetragonal-Trisoctahedron and Cube.
13. Tetragonal-Trisoctahedron.
14. Cube and Trigonal-Trisoctahedron.
15. Trigonal-Trisoctahedron and Cube.
16. Trigonal-Trisoctahedron.
17. Cube and Hexoctahedron.
18. Hexoctahedron and Cube.
19. Hexoctahedron.

RHOMBIC DODECAHEDRON.

20. Rhombic Dodecahedron and Cube.
21. Rhombic Dodecahedron and Tetrahexahedron.
22. Rhombic Dodecahedron and Octahedron.
23. Rhombic Dodecahedron Tetragonal-Trisoctahedron.
24. Rhombic Dodecahedron and Trigonal-Trisoctahedron.
25. Rhombic Dodecahedron and Hexoctahedron.

TETRA-HEXAHEDRON.

26. Tetrahexahedron and Cube.
27. Tetrahexahedron and Rhombic Dodecahedron.
28. Tetrahexahedron and Octahedron.

OCTAHEDRON.

29. Octahedron and Cube.
30. Octahedron and Rhombic Dodecahedron.
31. Octahedron and Tetrahexahedron.
32. Octahedron and Tetragonal-Trisoctahedron.
33. Octahedron and Trigonal-Trisoctahedron.
34. Octahedron and Hexoctahedron.

TETRAGONAL-TRISOCTAHEDRON.

35. Tetragonal-Trisoctahedron and Cube.
36. Tetragonal-Trisoctahedron and Rhombic Dodecahedron.
37. Tetragonal-Trisoctahedron and Octahedron.

TRIGONAL-TRISOCTAHEDRON.

38. Trigonal-Trisoctahedron and Cube.
39. Trigonal-Trisoctahedron and Rhombic Dodecahedron.
40. Trigonal-Trisoctahedron and Octahedron.

HEXOCTAHEDRON.

41. Hexoctahedron and Cube.
42. Hexoctahedron and Rhombic Dodecahedron.
43. Hexoctahedron and Octahedron.

HEMIHEDRAL FORMS WITH INCLINED FACES.

HEMI-OCTAHEDRON.

44. Cube and Hemi-Octahedron (Tetrahedron).
45. Hemi-Octahedron and Cube.
46. Positive Hemi-Octahedron.
47. Negative Hemi-Octahedron.

HEMI-TETRAGONAL-TRISOCTAHEDRON.

48. Cube and Hemi-Tetragonal-Trisoctahedron.
49. Hemi-Tetragonal-Trisoctahedron and Cube.
50. Positive Hemi-Tetragonal Trisoctahedron.
51. Negative Hemi-Tetragonal-Trisoctahedron.

HEMI-TRIGONAL-TRISOCTAHEDRON.

52. Cube and Hemi-Trigonal-Trisoctahedron.
53. Hemi-Trigonal-Trisoctahedron and Cube.

54. Positive Hemi-Trigonal-Trisoctahedron.
55. Negative Hemi-Trigonal-Trisoctahedron.

HEMI-HEXOCTAHEDRON.

56. Cube and Hemi-Hexoctahedron.
57. Hemi-Hexoctahedron and Cube.
58. Positive Hemi-Hexoctahedron.
59. Negative Hemi-Hexoctahedron.

HEMIHEDRAL FORMS WITH PARALLEL FACES.

HEMI-TETRAHEXAHEDRON.

(Pentagonal Dodecahedron.)

60. Cube and Hemi-Tetrahexahedron.
61. Hemi-Tetrahexahedron and Cube.
62. Positive Hemi-Tetrahexahedron.
63. Negative Hemi-Tetrahexahedron.

HEMI-HEXOCTAHEDRON.

64. Cube and Hemi-Hexoctahedron.
65. Hemi-Hexoctahedron and Cube.
66. Positive Hemi-Hexoctahedron (Diploid).
67. Negative Hemi-Hexoctahedron (Diploid).
68. Positive Hemi-Hexoctahedron (Gyroid.)
69. Negative Hemi-Hexoctahedron (Gyroid).

TETARTOHEDRAL FORMS.

70. Positive Tetartohexoctahedron alternate planes of fig. 58.
71. Positive Tetartohexoctahedron alternate planes of fig. 58.
72. Negative Tetartohexoctahedron alternate planes of fig. 59.
73. Negative Tetartohexoctahedron alternate planes of fig. 59.

COMBINATIONS.

74. Positive and negative Hemi-Octahedron.
75. Positive Hemi-Octahedron and Rhombic Dodecahedron.
76. Positive Hemi-Octahedron and positive Hemi-Trigonal-Trisoctahedron.
77. Negative Hemi-Octahedron and positive Hemi-Trigonal-Trisoctahedron.
78. Positive Hemi-Octahedron and positive Hemi-Trigonal-Trisoctahedron.
79. Positive Hemi-Octahedron and negative Hemi-Trigonal-Trisoctahedron.
80. Positive Hemi-Tetragonal-Trisoctahedron and positive Hemi-Octahedron.
81. Positive Hemi-Tetragonal-Trisoctahedron and negative Hemi-Octahedron.
82. Positive Hemi-Tetragonal-Trisoctahedron and positive Hemi-Octahedron.
83. Positive Hemi-Octahedron and negative Hemi-Tetragonal-Trisoctahedron.
84. Positive Hemi-Hexoctahedron inclined and positive Hemi-Octahedron.
85. Positive Hemi-Hexoctahedron inclined and negative Hemi-Octahedron.
86. Positive Hemi-trigonal-Trisoctahedron and Rhombic Dodecahedron.
87. Rhombic Dodecahedron and positive Hemi-Tetragonal-Trisoctahedron.
88. Positive Hemi-Tetragonal Trisoctahedron and Rhombic Dodecahedron.
89. Positive Hemi-Tetragonal-Trisoctahedron and Rhombic Dodecahedron.
90. Rhombic Dodecahedron and positive Hemi-Hexoctahedron inclined.
91. Positive Hemi-Hexoctahedron inclined and Rhombic Dodecahedron.
92. Octahedron and Positive Hemi-Tetrahexahedron.
93. Positive Hemi-Tetrahexahedron and Octahedron.
94. Positive Hemi-Tetrahexahedron and Octahedron (Icosahedron).
95. Octahedron and Positive Hemi-Hexoctahedron parallel.
96. Positive Hemi-Hexoctahedron parallel and Octahedron.
97. Rhombic Dodecahedron and Positive Hemi-Tetrahexahedron.
98. Positive Hemi-Tetrahexahedron, and Rhombic Decahedron.
99. Positive Hemi-Hexoctahedron parallel and Rhombic Dodecahedron.
100. Positive Hemi-Tetrahexahedron and Negative Hemi-Hexoctahedron parallel.
101. Cube, positive and negative Hemi-Tetragonal-Trisoctahedron, negative Hemi-Trigonal Trisoctahedron, Positive Hemi-Octahedron, Rhombic Dodecahedron and Tetrahexahedron. Crystal of Tetrahedrite.
102. Cube, Rhombic Dodecahedron and Positive Hemi-Octahedron. Crystal of Boracite.
103. Cube, Rhombic Dodecahedron and Octahedron.
104. Cube, Rhombic Dodecahedron and Positive Hemi-Octahedron. Crystal of Boracite.
105. Cube, Rhombic Dodecahedron, Tetragonal-Trisoctahedron, Trigonal-Trisoctahedron, and Hexoctahedron. Crystal of Fluor.

DIMETRIC SYSTEM.

HOLOHREDAL FORMS.

106. Right square prism, 1st order with axes.
107. Right square prism, 2d order with axes.
108. Right square prism of the 1st order with axes and Octahedron of the first order.
109. Square Octahedron of the 1st order.
110. Square Octahedron of the 1st order.
111. Square Octahedron of the 1st order.
112. Square prism of the 1st order with Octahedron of the second.
113. Square Octahedron of the 2d order.
114. Square Octahedron of the 2d order.
115. Square Octahedron of the 2d order.
116. Octahedron of the 1st and 2d order.
117. Dioctahedron.
118. Dioctahedron.
119. Octagonal prism.

HEMIHEDRAL FORMS.

120. Positive Sphenoid 1st order, and Octahedron of the 1st order.
121. Negative Sphenoid 2d order, and Prism of the 1st order.
122. Negative Sphenoid, 2d order.
123. Positive Sphenoid, 2d order.
124. Positive Octahedron of the 3d order, with the base of the Dioctahedron.
125. Negative Octahedron of the 3d order, with the base of the Dioctahedron.
126. Positive square Trapezohedron.
127. Negative square Trapezohedron at another angle.
128. Positive square Trapezohedron.
129. Negative square Scalenohedron.
130. Positive square Scalenohedron at another angle.
131. Negative square Scalenohedron.

COMBINATIONS.

132. Dioctahedron and Octahedron of the 2d order.
133. Dioctahedron and Octagonal Prism.
134. Dioctahedron and Octagonal Prism.
135. Dioctahedron and Prism of the 2d order.
136. Dioctahedron and Basal Pinacoid.
137. 2 Octahedra of the 2d order.
138. Octahedra of the 1st and 2d orders.
139. 3 Octahedra of the 1st order, with Prism of the 1st and 2d orders.
140. Octahedron of the 2d order and Octagonal Prism.
141. Octahedron of the 2d order, and Prism of the 2d order.
142. 3 Octahedra of the 1st order, with Prisms of the 1st and 2d orders and Dioctahedron.
143. Octahedron of the 2d order and Prism of the 1st order.
144. Octagonal Prism, square Prism of the 2d order, and Basal Pinacoid.
145. Square Prisms of the 1st and 2d orders and Basal Pinacoid.
146. Positive and negative Sphenoid 2d order.
147. Positive Sphenoid 2d order and square Prism of the 2d order.
148. Positive Sphenoid 2d order and square Prism of the 1st order.
149. Octahedron of the 1st order with positive Sphenoid of the 2d order.
150. Octahedron of the 1st order with negative square Scalenohedron.
151. Octahedron of the 1st order and negative Sphenoid, 2d order.
152. Square Prism of 1st and 2d orders; 3 Octahedra of the 2d order; Octahedron of the 2d order, and 5 Dioctahedra and Octagonal Prism. Idocrase.
153. Crystal of the Hexagonal System, resembling fig. 152. Hexagonal Prism, 1st and 2d orders, Basal Pinacoid; 3 Hexagonal pyramids of the 1st order; 1 Hexagonal pyramid of the 2d order; 3 Hexagonal pyramids, 3d order. Crystal Apatite.
154. Positive and negative Sphenoid, 2d order; Prism 2d order; Octahedron 1st order; Positive square Scalenohedron. Crystal of Chalcopyrite.
155. Positive and negative Sphenoid, 2d order; Basal Pinacoid; 2 Hemi-Dioctahedra. Crystal of Chalcopyrite.
156. Octahedra of the 1st, 2d, and 3d orders.

TRIMETRIC SYSTEM.

HOLOHEDRAL.

157. Right Rectangular Prism.
158. Right Rhombic Prism, 1st order.
159. Right Rhombic Prism, 2d order (Brachydome).
160. Right Rhombic Prism, 3d order (Macrodome), in a Rectangular Prism.
161. Rhombic Octahedron.

HEMIHEDRAL.

162. Negative Rhombic Sphenoid.
163. Positive Rhombic Sphenoid.

COMBINATIONS.

164. Rhombic Octahedron, right Rectangular Prism and Basal Pinacoid.
165. Rhombic Octahedron and right Rhombic Prism of the 1st order.
166. Rhombic Octahedron and right Rhombic Prism of the 2d order.
167. Rhombic Octahedron and right Rhombic Prism of the 1st and 2d orders.
168. Rhombic Octahedron and right Rhombic Prism, 2d and 3d orders.
169. 3 Rhombic Octahedra.
170. 2 right Rhombic Prisms of the 1st order, 1 of the 2d order and Basal Pinacoid.
171. Right Rhombic Prism, 1st order, Basal Pinacoid, Brachy Pinacoid and Rhombic Octahedron.
172. Right Rhombic Prism of the 1st, 2d and 3d orders. 2 Rhombic Octahedra and Brachy Pinacoid.

MONOCLINIC SYSTEM.

173. Oblique Rectangular Prism with axes.
174. Oblique Rhombic Prism 1st order.
175. Oblique Rhombic Prism 2d order.
176. Oblique Rhombic Octahedron (composite form).
177. Macro Pinacoid and two Hemi-Orthodomes.
178. Oblique Rhombic Prism 1st order, Macro Pinacoid, Hemi-Orthodome and modification of the obtuse solid angles. Crystal of Hornblende.
179. Same as Fig. 178, but an intermediate position of the modifying planes. Crystal of Hornblende.
180. Oblique Rhombic Prism 1st order, Basal, Macro and Brachy Pinacoids and Hemi-Orthodome. Crystal of Pyroxene.
181. Oblique Rhombic Prism of the 1st and 2d orders, Basal, Macro and Brachy Pinacoids. Crystal of Hornblende.
182. Oblique Rhombic Prism of the 1st and 2d orders, and Macro and Brachy Pinacoids, Crystal of Pyroxene.
183. Oblique Rhombic Prism of the 1st order and modifications on the obtuse solid angles. Crystal of Hornblende.
184. Oblique Rhombic Prism 1st and 2d orders, Brachy Pinacoid, Hemi-Orthodome, Basal Pinacoid and modification on the acute and obtuse solid angles (Oblique Rhombic Octahedron). Crystal of Pyroxene.
185. Oblique Rhombic Prism 1st order, Basal, Macro and Brachy Pinacoids, Hemi-Orthodome and Oblique Rhombic Octahedron. Crystal of Pyroxene.
186. Oblique Rhombic Prism 1st and 2d orders, Macro and Brachy Pinacoid, Basal Pinacoid, Hemi-Orthodome and Oblique Rhombic Octahedron. Crystal of Pyroxene.

TRICLINIC SYSTEM.

187. Doubly Oblique Prism 1st order.
188. Doubly Oblique Prism 2d order.
189. Doubly Oblique Prism 3d order.
190. Doubly Oblique Prism 4th order.
191. Doubly Oblique Octahedron.
192. Crystal of Feldspar.
193. Crystal of Axinite.

Fig. 194. Crystal of Albite.
“ 195. Crystal of Albite.
“ 196. Crystal of Albite.
“ 197. Crystal of Anorthite.
Fig. 198. Crystal of Anorthite.
“ 199. Crystal of Oligoclase.
“ 200. Crystal of Cyanoysite.

HEXAGONAL SYSTEM.

HOLOHEDRAL FORMS.

PLATE XVI.

Fig. 1. Hexagonal Prism, 1st order, with axes.
“ 2. Hexagonal Prism, 2d order, with axes.
“ 3. Hexagonal Prism of the 1st and 2d orders.
“ 4. Hexagonal Prism of the 2d order.
“ 5. Hexagonal and Dihexagonal Prisms.
“ 6. Dihexagonal Prism.
“ 7. Hexagonal Prism of the 1st order, Hexagonal Pyramid of the 1st order, and Basal Pinacoid.
“ 8. Hexagonal Pyramid of 1st order, and Basal Pinacoid.
“ 9. Hexagonal Pyramid of the 1st order.
“ 10. Hexagonal Pyramid at a different angle from Fig. 9.
“ 11. Hexagonal Pyramid at a different angle from Fig. 9.
“ 12. Hexagonal Pyramid and Hexagonal Prism.

PLATE XVII.

Fig. 1. Hexagonal Prism of the 1st order, and Hexagonal Pyramid of the 2d, and Basal Pinacoid.
“ 2. Hexagonal Pyramid of the 2d order, with axes.
“ 3. Hexagonal Pyramid of the 2d order, at a different angle from Fig. 2.
“ 4. Hexagonal Pyramid of the 2d order, at a different angle from Fig. 3.
“ 5. Hexagonal Prism and Dihexagonal Pyramid, and Basal Pinacoid.
“ 6. Dihexagonal Pyramid.
“ 7. Dihexagonal Pyramid at a different angle from Fig. 6.
“ 8. Trigonal Prism and Basal Pinacoid, alternate to Fig. 9.
“ 9. Trigonal Prism and Basal Pinacoid, alternate to Fig. 8.
“ 10. Trigonal Pyramid, alternate to Fig. 11.
“ 11. Trigonal Pyramid, alternate to Fig. 10.
“ 12. Hexagonal Prism, Basal Pinacoid and Rhombohedron.

HEMIHEDRAL FORMS.

PLATE XVIII.

Fig. 1. Rhombohedron with axes.
“ 2. Obtuse Rhombohedron with axes.
“ 3. Obtuse Rhombohedron with axes.
“ 4. Obtuse Rhombohedron with axes.
“ 5. Acute Rhombohedron with axes.
“ 6. Acute Rhombohedron with axes.
“ 7. Rhombohedron of one order, with one of another order enclosed.
“ 8. Rhombohedron and another of the same order, but different angle.
“ 9. Rhombohedron of the 1st order, with one of the 2d Passage to a Hexagonal Pyramid.
“ 10. Obtuse and acute Rhombohedra.

PLATE XIX.

Fig. 1. Acute Rhombohedron and Scalenohedron.
“ 2. Scalenohedron alternate to fig. 3, and enclosed Rhombohedron.
“ 3. Scalenohedron alternate to Fig. 2, and enclosed Rhombohedron.
“ 4. Scalenohedron at a different angle from figs. 2 and 3, and enclosed Rhombohedron.
“ 5. Rhombohedron with a Scalenohedron on the terminal edges.
“ 6. Rhombohedron with a Scalenohedron on the terminal angles.
“ 7. Rhombohedron with a Scalenohedron on the lateral angles.
“ 8. Rhombohedron and Hexagonal Prism of the 1st order.
“ 9. Rhombohedron enclosed in an Hexagonal Prism of the 1st order.
“ 10. Rhombohedron and Hexagonal Prism of the 2d order.
“ 11. Rhombohedron enclosed in an Hexagonal Prism of the 2d order.
“ 12. Hexagonal Prism, Hexagonal Pyramid and Trigonal Prism. Crystal of Quartz.

PLATE XX.

Fig. 1. Hemi-Dihexagonal Prism and Basal Pinacoid.
“ 2. Hexagonal Prism, Hemi-Dihexagonal Pyramid and Basal Pinacoid.
“ 3. Hexagonal Prism, Basal Pinacoid and Hemi-Dihexagonal Pyramid

PLATE XX.

(Hexagonal Trapezohedron, or Hexagonal Plagihedron.)
Fig. 4. Hemi-Dihexagonal Pyramid.
" 5. Hexagonal Plagihedron at another angle.
" 6. Hexagonal Prism, Basal Pinacoid and Hemi-Dihexagonal Pyramid alternate to fig. 3.
" 7. Hexagonal Plagihedron, alternate to fig. 4.
" 8. Hexagonal Plagihedron at another angle, alternate to fig. 5.
" 9. Tetarto-Dihexagonal Pyramid (Plagihedron or Trigonal Trapezohedron.)
" 10. Tetarto-Dihexagonal Pyramid (Plagihedron), alternate to fig. 9.
" 11. Plagihedron an another angle.
" 12. Hexagonal Prism, Hexagonal Pyramid and Plagihedron. Crystal of Quartz.

COMBINATIONS.

PLATE XXI.

Fig. 1. Hexagonal Prism and Rhombohedron of the 1st order, and enclosed Rhombohedron of the 2d order.
" 2. Hexagonal Prism and Rhombohedron of the 2d order.
" 3. Hexagonal Prism and Hexagonal Pyramid.
" 4. Hexagonal Prism, Hexagonal Pyramid and Trigonal Pyramid. Crystal of Quartz.
" 5. Hexagonal Prism, Hexagonal Pyramid, Trigonal Pyramid with Plagihedron alternate to fig. 6, Crystal of Quartz.
" 6. Hexagonal Prism, Hexagonal Pyramid, Trigonal Pyramid with Plagihedron alternate to fig. 5, Crystal of Quartz.
" 7. Hexagonal Pyramid and Hexagonal Prism.
" 8. Hexagonal Prism and Trigonal Pyramid on the angles.
" 9. Hexagonal Prism and Trigonal Pyramid on the edges.

PLATE XXI.

Fig. 10. Hexagonal Prism, Basal Pinacoid, two Hexagonal Pyramids of the 1st order, one of the 2d, and Scalenohedron. Crystal of Beryl.
" 11. Acute Rhombohedron and Basal Pinacoid. Crystal of Ilmenite.
" 12. Two acute Rhombohedra and Basal Pinacoid. Crystal of Ilmenite.
" 13. Acute Rhombohedron and Basal Pinacoid. Crystal of Calcite.
" 14. Rhombohedron and Trigonal Prism.

PLATE XXII.

Fig. 1. Scalenohedron and Rhombohedron.
" 2. Scalenohedron and Hexagonal Prism of the 2d order.
" 3. Scalenohedron and Hexagonal prism of the 1st order.
" 4. 2 Rhombohedra, 3 Scalenohedra and Hexagonal prism. Crystal of Calcite.
" 5. 4 Rhombohedra, 2 Scalenohedra and Hexagonal Prism. Crystal of Calcite.
" 6. Hexagonal Prism of the 1st and 2d orders, 3 Hexagonal Pyramids of the 1st order, three of the 2d order, and Basal Pinacoid. Crystal of Apatite.
" 7. Two Rhombohedra, Hexagonal Prisms of the 1st and 2d orders and Scalenohedron. In the Monometric system, Rhombic Dodecahedron, and Tetragonal-Trisoctahedron.
" 8. 4 Hexagonal Pyramids, 1 Hexagonal Prism, 5 left Plagihedra, 1 right Plagihedron, Hemi-Dihexagonal prism. Crystal of Quartz.
" 9. Two Rhombohedra, Hexagonal Prism of the 2d order and Basal Pinacoid. In the Monometric System, Cube, Rhombic, Dodecahedron and Octahedron.

IMPERFECTIONS OF CRYSTALS.

STRIATIONS.

PLATE XXIII.

Fig. 1. Oscillation between the Cube and Hemi-Tetrahexahedron. Crystal of Pyrites.

PLATE XXIII.

Fig. 2. Oscillation between the Hemi-Tetrahexahedron and Cube. Crystal of Pyrites.

PLATE XXIII.

Fig. 3. Intersection of the Cube and Hemi-Tetrahexahedron.
" 4. Oscillation between the Octahedron and Rhombic Dodecahedron. Crystal of Magnetite.
" 5. Intersection of the Cube and Rhombic Dodecahedron.
" 6. Intersection between the Octahedron and Rhombic Dodecahedron.
" 7. Two Hemi-Tetrahexahedra interpenetrated. Crystal of Pyrites.
" 8. The same, compressed, showing the partial striations on both.
" 9. Cube, showing by its striations that it is made of Two Hemi-Tetrahexahedra. Crystal of Pyrites.
" 10. Oscillation between the Cube and Tetrahedron.
" 11. Acute Octahedron of the 1st and 2d order of the Dimetric System, with Two Hemi-Dioctahedra. The striations show an oscillation between the Octahedron and Sphenoid. Crystal of Scheelite.
" 12. Same Crystal. The striations show that it has been turned round on its vertical axis.

PLATE XXIV.

Fig. 1. Group of four Crystals, showing an oscillation between the Prism and Macrodome. Crystal of Aragonite.
" 2. Group of two Crystals, showing an oscillation between the Rectangular and Rhombic Prisms. Crystal of Harmotome.
" 3. Hexagonal Prism and Rhombohedron showing an oscillation towards the alternate Rhombohedron. Crystal of Calcite.
" 4. Deformed Crystal, showing oscillation between the Hexagonal Prism and Hexagonal Pyramid. Crystal of Quartz.
" 5. Striations produced by piling one Crystal on another. Crystal of Quartz.

IMPERFECT FACES.

Fig. 6. Hollow Cube of Salt.
" 7. Hollow Octahedron of Gold.
" 8. Hollow Octahedron of Cuprite.
" 9. Hollow Basal Pinacoid of Calcite.
" 10. Rounded Hexagonal Prism of Calcite capped by a perfect Crystal.
" 11. Rounded Crystal of Marcasite.

PLATE XXIV.

Fig. 12. Rounded Crystal of Gypsum.
" 13. Complete curve of Fig. 12.
" 14. Crystal of Dolomite.

PLATE XXV.

Fig. 1. Crystal of Dolomite or Chalybite.
" 2. Crystal of Diamond.
" 3. Crystal of Diamond.
" 4. Crystal of Diamond.

DISTORTED CRYSTALS.

" 5. Crystal of Diamond.
" 6. Shows how an Octahedron may be deformed.
" 7. Octahedron flattened parallel to a face. Crystal of Spinelle. Cleavage Crystal of Fluor.
" 8. Octahedron flattened parallel to a face. Cleavage of Fluor. Crystal of Spinelle.
" 9. Octahedron extended parallel to one of the horizontal axes. Cleavage of Fluor. Crystal of Spinelle.
" 10. Octahedron lengthened parallel to two of the faces. Cleavage of Fluor.
" 11. Octahedron lengthened parallel to two of the faces until they are obliterated. Cleavage of Fluor.
" 12. Rhombic Dodecahedron lengthened in the direction of a Diagonal, joining the obtuse solid angles. Crystal Blende.
" 13. Rhombic Dodecahedron lengthened in direction of the vertical axis.
" 14. Rhombic Dodecahedron shortened in the direction of a Diagonal, joining the obtuse solid angles. Crystals of Garnet and Blende.
" 15. Acute Rhombohedron produced by continued shortening of the Rhombic Dodecahedron in the direction of the Diagonal, joining the obtuse solid angles.

PLATE XXVI.

Fig. 1. Rhombic Dodecahedron shortened in the direction of the vertical axis.
" 2. Tetragonal-Trisoctahedron lengthened in the direction of an Octahedral axis.
" 3. Tetragonal-Trisoctahedron lengthened to the obliteration of some of the faces, becomes a Scalenohedron. Crystal of Fluor.

PLATE XXVI.

Fig. 4. Tetragonal-Trisoctahedron lengthened in the direction of the vertical axis.

" 5. Tetragonal-Trisoctahedron lengthened in the direction of the vertical axis to the obliteration of some of the faces, becomes a Dioctahedron.

" 6. Tetragonal-Trisoctahedron lengthened in the direction of the vertical axis. Crystal of Salammoniac or Leucte.

" 7. Combination of the Rhombic Dodecahedron and Tetragonal-Trisoctrahedron, altered by elongation so that only four faces of the Rhombic Dodecahedron. Crystal of Garnet.

" 8. Hexagonal Prism and Hexagonal Pyramid. Crystal of Quartz.

" 9. Same as fig. 8, but flattened parallel to two of the faces of the Prism. Crystal of Quartz.

" 10. Hexagonal Prism and Hexagonal Pyramid, lengthened parallel to two of the faces of the Pyramid. Crystal of Quartz.

" 11. Hexagonal Prism and Hexagonal Pyramid, flattened parallel to two of the faces of the Pyramid. Crystal of Quartz.

Fig. 12. Scalenohedron and Rhombohedron, flattened parallel to two of the faces of the Scalenohedron. Crystal of Calcite.

" 13. Hexagonal Prisms of the 1st and 2d order, three Hexagonal Pyramids of the 1st order and one of the 2d, two Hemi-Dihexagonal Pyramids and Basal Pinacoid. Distorted Crystal of Apatite.

" 14. Perfect Crystal, showing the position of the faces in fig. 13.

" 15. Hexagonal Prism and Basal Pinacoid. Distorted Crystal of Beryl.

PLATE XXVII.

Fig. 1. Curved Crystal of Quartz, from Rossie, N. Y.

" 2. Curved Crystal of Chlorite from New Hampshire.

" 3. Crystal of Beryl from Monroe, Ct.

" 4. Hemimorphic Crystal of Greenochite.

" 5. Hemimorphic Crystal of Tourmaline.

" 6. Hemimorphic Crystal of Calamine.

" 7. Hemimorphic Crystal of Quartz.

TWIN CRYSTALS.

MONOMETRIC SYSTEM.

PLATE XXVII.

Fig. 8. Octahedron, showing the axis and plane of Revolution.

" 9. Separation of the planes of the Octahedron when turned.

" 10. Octahedron Hemitrope. Twin of Spinelle and Native Silver.

" 11. Another view of fig. 10.

" 12. Cube showing the Axis and Plane of Revolution.

PLATE XXVIII.

Fig. 1. Cube turned in the direction of *a*, *b*. Crystal of Native Silver.

" 2. Cube turned in the direction of *c*, *d*.

" 3. Rhombic Dodecahedron showing the axis and plane of rotation.

" 4. Rhombic Dodecahedron, Hemitrope. Crystal of Blende.

" 5. Another view of fig. 4.

" 6. Rhomb produced by cleavage from the Rhombic Dodecahedron.

PLATE XXVIII.

Fig. 7. Cube turned as in fig. 1, and compressed so that the re-entrant angle has disappeared. Crystal of Native Silver from Kongsberg.

" 8. Tetrahexahedron turned round and compressed. Crystal of Native Copper.

" 9. Interpenetration of two Cubes. Crystals of Fluor.

" 10. Interpenetration of Two Cubes. Crystals of Fluor.

" 11. Twin Crystal made up of Cube, and Octahedron interpenetrating. Crystal of Tetrahedrite.

" 12. Two Crystals made up of Tetrahedron and Hemitetragonal-Trisoctahedron, and Rhombic Dodecahedron interpenetrating. Crystal of Tetrahedrite.

" 13. Two Tetrahedra interpenetrating. Crystal of Diamond.

PLATE XXVIII.

Fig. 14. Two Crystals made up of positive and negative Tetrahedra interpenetrating. Crystal of Diamond.
" 15. Two Positive and Negative Tetrahedra interpenetrating. Crystal of Diamond.

PLATE XXIX.

Fig. 1. Combination of two Crystals made up of Tetrahedra and Hemi-Hexahedra interpenetrated. Crystal of Diamond.

DIMETRIC SYSTEM.

" 2. Hemitrope of Cassiterite.
" 3. Hemitrope of Cassiterite.
" 4. Hemitrope of Cassiterite.
" 5. Hemitrope of Cassiterite.
" 6. Hemitrope of Cassiterite.
" 7. Hemitrope of Cassiterite.
" 8. Compound Crystal of Cassiterite.
" 9. Twin of Cassiterite.
" 10. Twin of Cassiterite.
" 11. Composite Crystal of Hausmanite.
" 12. Composite Crystal of Scheelite.

PLATE XXX.

Fig. 1. Composite Crystal of Chalcopyrite.
" 2. Composite Crystal of Chalcopyrite.
" 3. Composite Crystal of Chalcopyrite.
" 4. Composite Crystal of Chalcopyrite.
" 5. Twin of Rutile.
" 6. Twin of Rutile.
" 7. Twin of Rutile.
" 8. Geniculated Crystal of Rutile.

TRIMETRIC SYSTEM.

" 9. Twin of Staurotide.
" 10. Twin of Staurotide.
" 11. Composite Crystal of Chrysoberyl.
" 12. Composite Crystal of Chrysoberyl.

PLATE XXXI.

Fig. 1. Composite Crystal of Harmotome.
" 2. Twin of Cerusite.
" 3. Composite Crystal of Cerusite.
" 4. Composite Crystal of Cerusite.
" 5. Twin of Marcasite.
" 6. Composite Crystal of Marcasite.
" 7. Composite Crystal of Marcasite.
" 8. Twin of Manganite.
" 9. Twin of Manganite.
" 10. Twin of Manganite.
" 11. Composite Crystal of Copper Glance.
" 12. Twin of Copper Glance.

PLATE XXXII.

Fig. 1. Twin of Aragonite.
" 2. Composite Crystal of Aragonite.
" 3. Twin of Aragonite.

MONOCLINIC SYSTEM.

" 4. Crystal of Gypsum.
" 5. Twin Crystals of No. 4.
" 6. Hemitrope of No. 4.
" 7. Hemitrope of Amphibole.
" 8. Hemitrope of Pyroxene.
" 9. Hemitrope of Orthoclase from St. Gothard.
" 10. Hemitrope of Orthoclase from Baveno.
" 11. Crystal of Orthoclase from Baveno.
" 12. Composite Group of Crystals of No. 11.

PLATE XXXIII.

Fig. 1. Orthoclase.
" 2. Crystal of Orthoclase.
" 3. Twin of 1 and 2 Orthoclase from Carlsbad.
" 4. Twin of 1 and 2 Orthoclase from Carlsbad.
" 7. Twin of Adularia from St. Gothard.

TRICLINIC SYSTEM.

" 5. Twin of Oligoclase.
" 6. Twin of Albite.
" 8. Twin of Albite.
" 9. Twin of Albite, variety Pericline.

HEXAGONAL SYSTEM.

" 10. Twin of Chabazite.
" 11. Crystal of Hematite.
" 12. Crystal of Hematite.
" 13. Twin of Fig. 11 and 12.

PLATE XXXIV.

Fig. 1. Group of Pyrargyrite Crystals.
" 2. Group of Tetradymite Crystals.
" 3. Twin of Calcite.
" 4. Twin of Calcite.
" 5. Twin of Calcite.
" 6. Twin of Calcite.
" 7. Twin of Calcite.
" 8. Twin of Calcite.
" 9. Twin of Calcite.
" 10. Twin of Calcite.
" 11. Twin of Calcite.
" 12. Twin of Calcite.

PLATE XXXV.

Fig. 1. Group of Calcite.
" 2. Twin of Quartz.
" 3. Twin of Quartz.
" 4. Twin of Quartz.
" 5. Twin of artz.

PLATE XXXV.

Fig. 6. Twin of Quartz.
" 7. Twin of Quartz.
" 8. Group of Quartz.
" 9. Group of Quartz.
" 10. Group of Snow Crystals.
" 11. Group of Snow Crystals.
" 12. Group of Snow Crystals.
" 13. Group of Snow Crystals.

PLATE XXXV.

Fig. 14. Group of Snow Crystals.
" 15. Group of Snow Crystals.
" 16. Group of Snow Crystals.
" 17. Group of Snow Crystals.
" 18. Group of Snow Crystals.
" 19. Group of Snow Crystals.
" 20. Group of Snow Crystals.

MEASUREMENT OF ANGLES.

PLATE XXXVI.

Fig. 1. Inclination of two planes.
" 2. Lines showing the angles.
" 3. Graduated Semicircle of Hauy's Goniometer.
" 4. Moveable arms of Hauy's Goniometer.
" 5. Hauy's Goniometer complete.

PLATE XXXVI.

Fig. 6. Methods of measurement by Wollaston's Goniometer.
" 7. Methods of measurement by Wollaston's Goniometer.
" 8. Methods of measurement by Wollaston's Goniometer.
" 9. Wollaston's Goniometer.

FORMATION OF CRYSTALS.

PLATE XXXVI.

Fig. 10. Formation of the Rhombic Dodecahedron.
" 11. Formation of the Rhombic Dodecahedron.
" 12. Formation of the Rhombic Dodecahedron.
" 13. Formation of the Tetrahexahedron.
" 14. Formation of the Tetrahexahedron.

PLATE XXXVII.

Fig. 1. Formation of the Hemitetrahexahedron.
" 2. Formation of the Octahedron.
" 3. Formation of the Tetragonal Trisoctahedron.
" 4. Formation of the Trigonal Trisoctahedron.

PLATE XXXVII.

Fig. 5. Formation of the Hexoctahedron.
" 6. Octahedron composed of Octahedral molecules.
" 7. Octrahedron composed of Tetrahedral molecules.
" 8. Tetrahedron composed of Octahedral molecules.
" 9. Tetrahedron composed of Tetrahedral molecules.
" 10. Octahedron composed of spherical molecules.
" 11. Tetrahedron composed of spherical molecules.
" 12. Cube composed of spherical molecules.
" 13. Rhombohedron composed of prolate spheroids.

PHYSICAL PROPERTIES OF MINERALS.

POLARISATION.

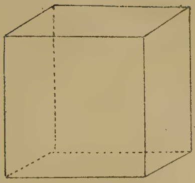
PLATE XXXVIII.

Fig 1. Colored rings and black cross of Crystals with one optical axis.
" 2. Supplementary rings and white cross of Crystals with one optical axis.
" 3. Colored rings and black line of Crystals with two optical axes.
" 4. Curves in Crystals of two optical axes. Crystals of Nitre.

PLATE XXXVIII.

Fig. 5. Curves and cross in Nitre at the commencement of rotation.
" 6. Curves and cross in Nitre after a slight movement.
" 7. Curves and cross in Nitre after a rotation of 22° 30′.
" 8. Curves and cross in Nitre after a rotation of 45°.

Pl. 1.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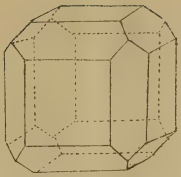
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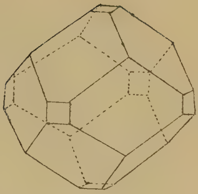
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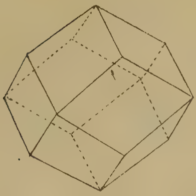
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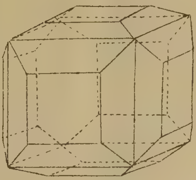
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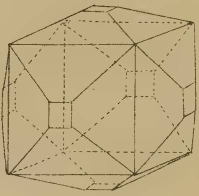
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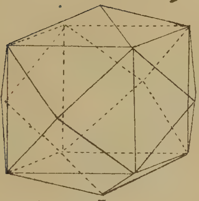
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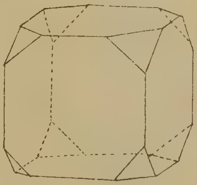
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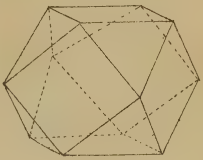
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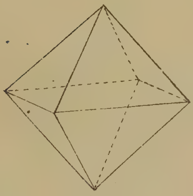
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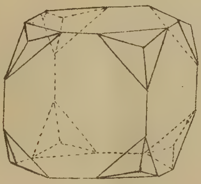
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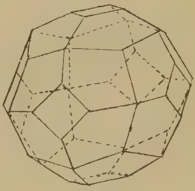
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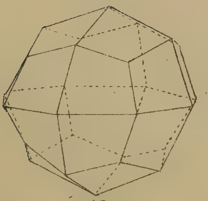
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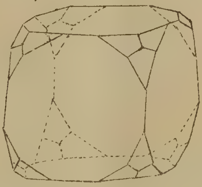
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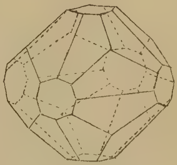
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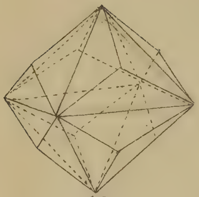
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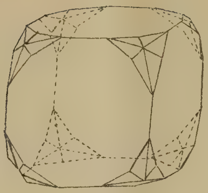
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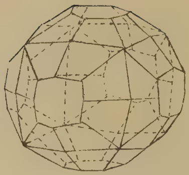
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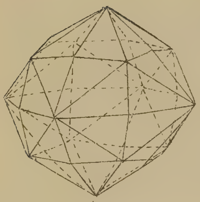
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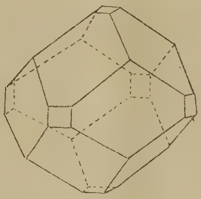
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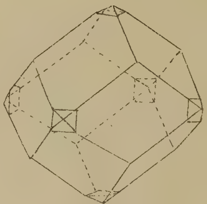
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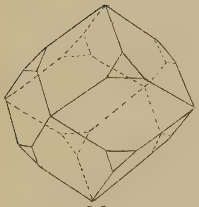
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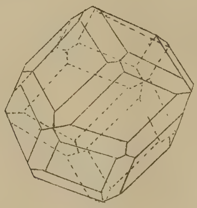
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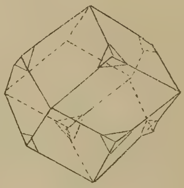
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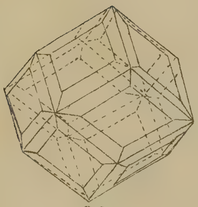
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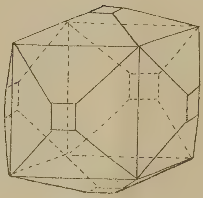
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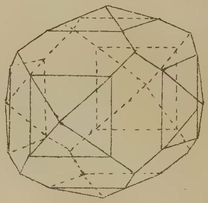
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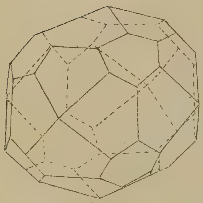
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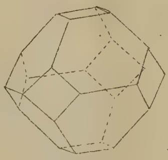
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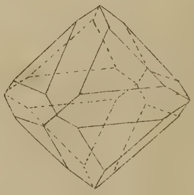
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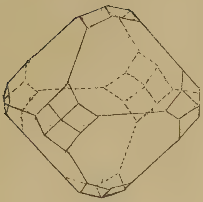
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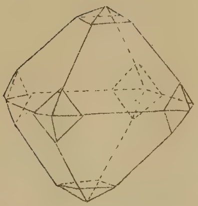
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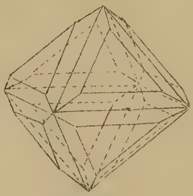
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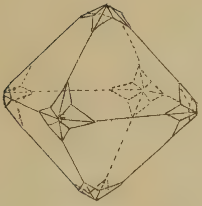
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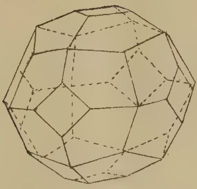
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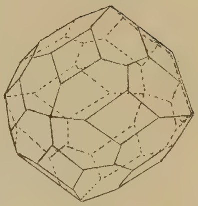
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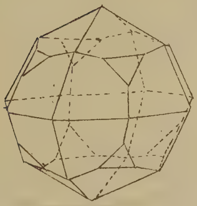
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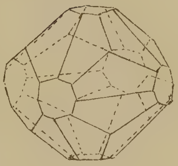
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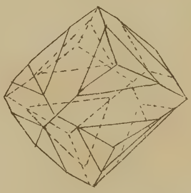
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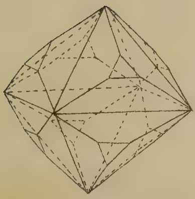
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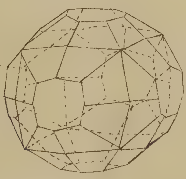
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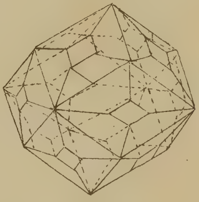
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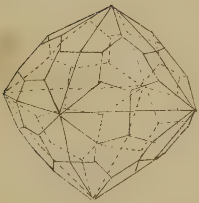
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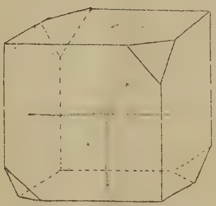
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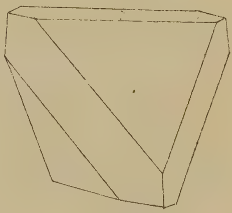
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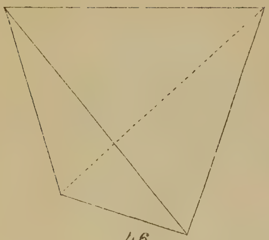
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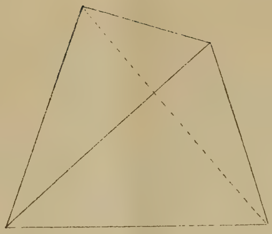
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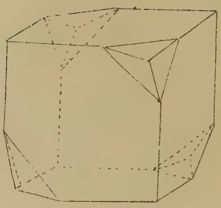
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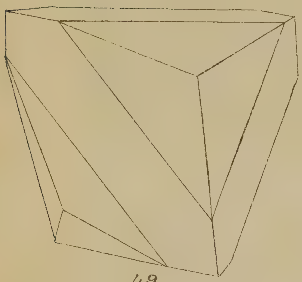
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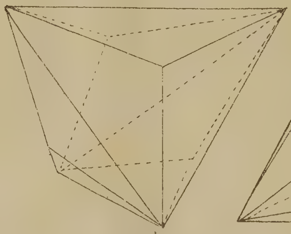
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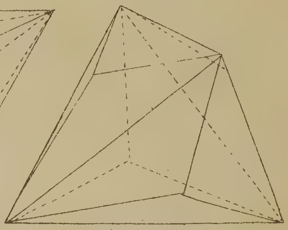
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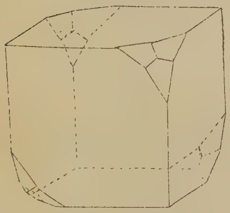
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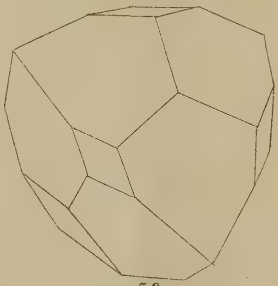
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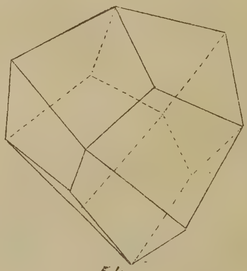
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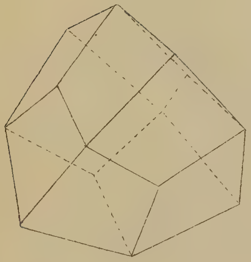
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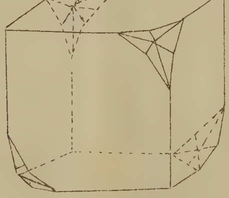
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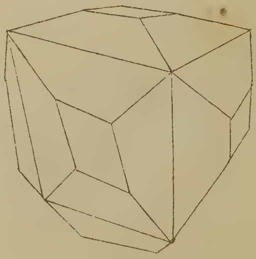
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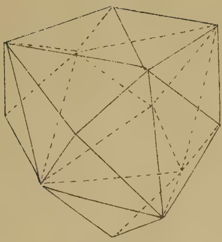

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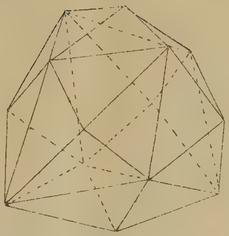

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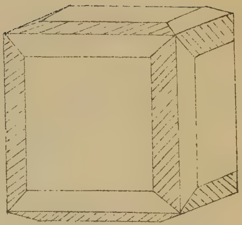

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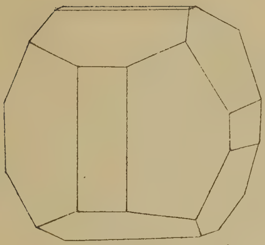

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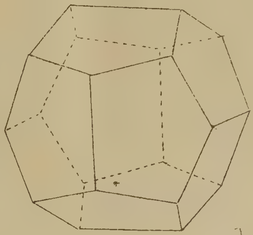

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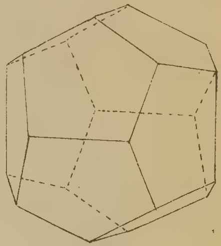

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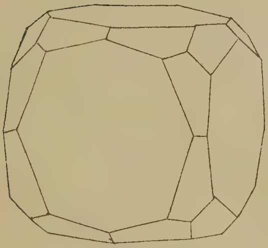

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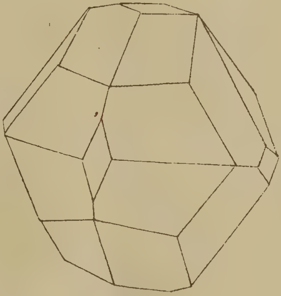

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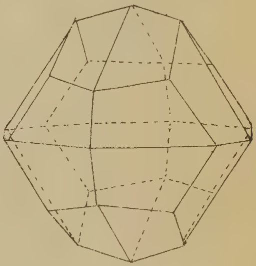

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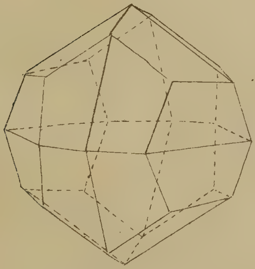

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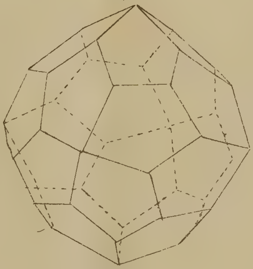

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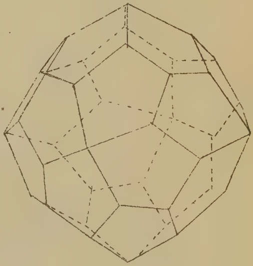

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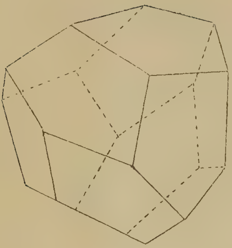
Pl.6.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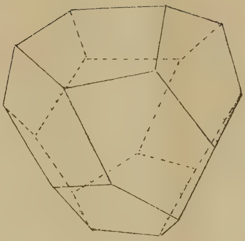
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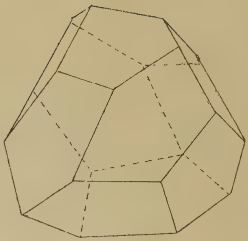
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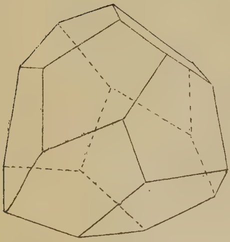
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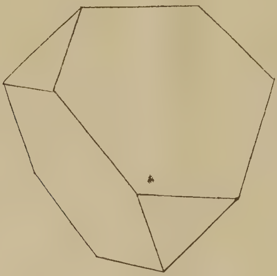
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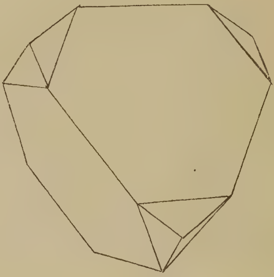
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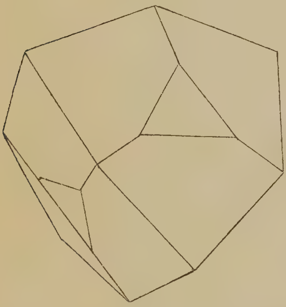
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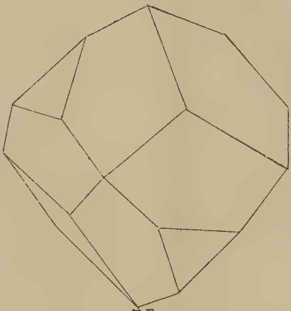
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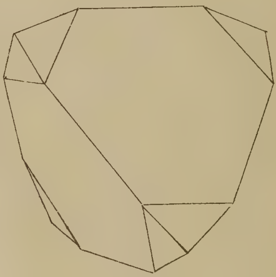
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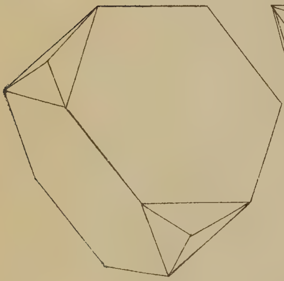
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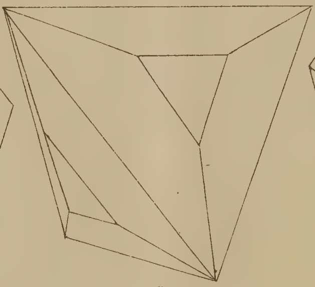
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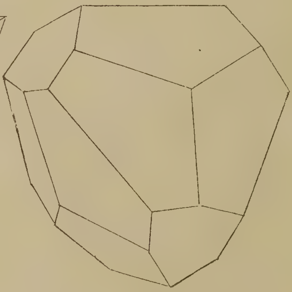
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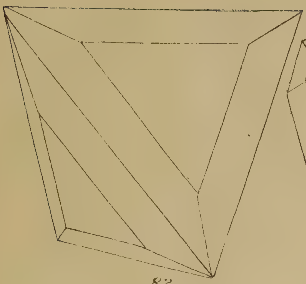
Pl. 7.



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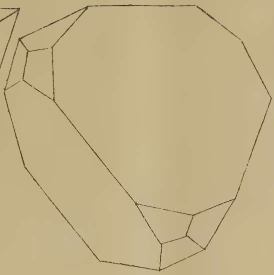

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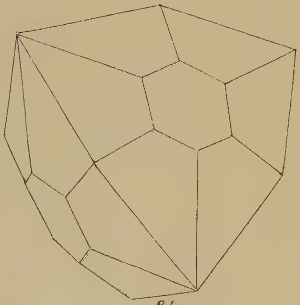

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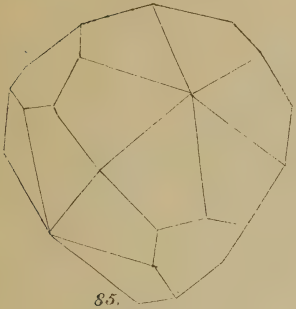

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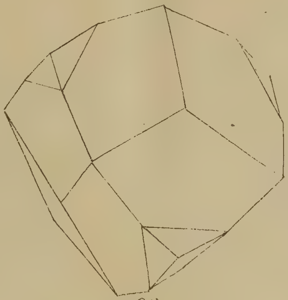

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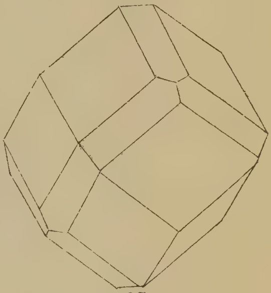

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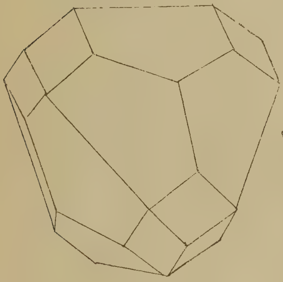

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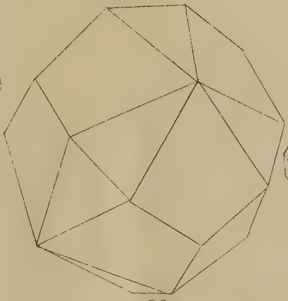

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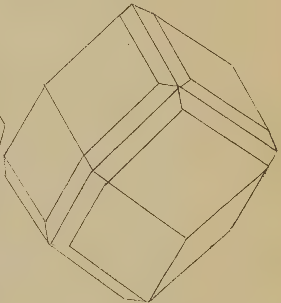

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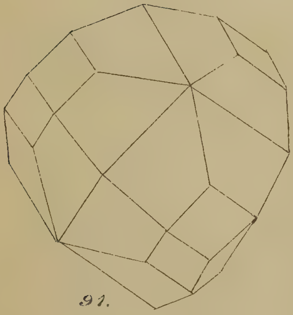

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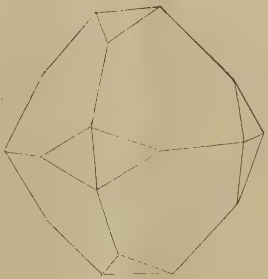

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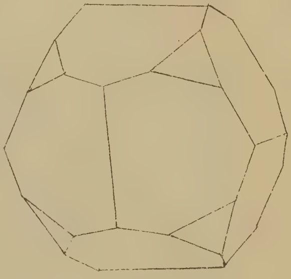

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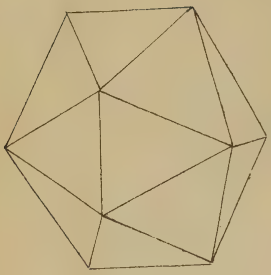
Pl.8.



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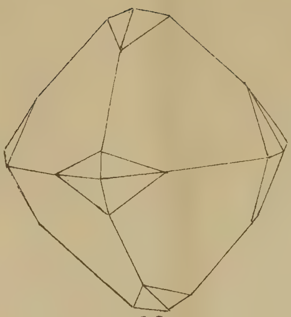

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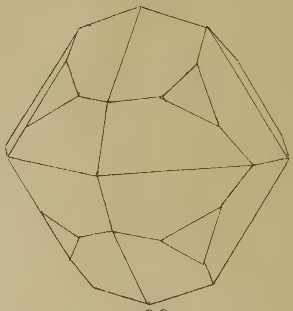

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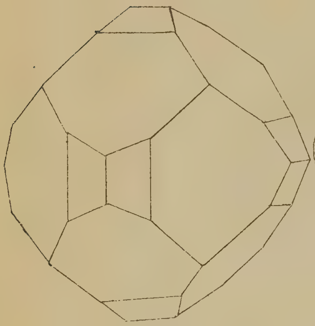

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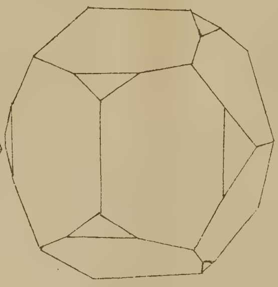

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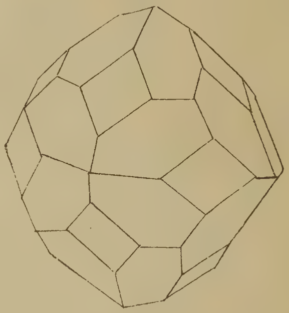

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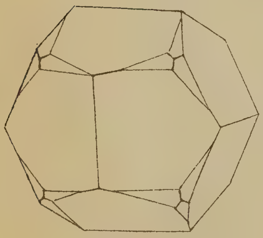

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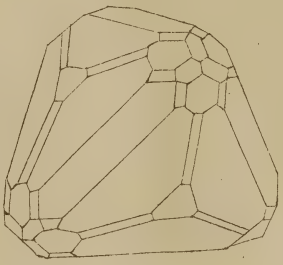

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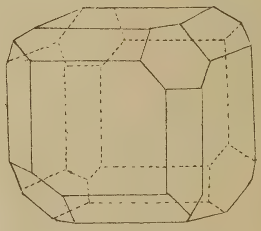

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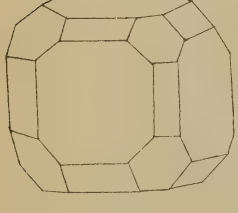

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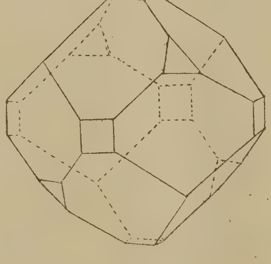

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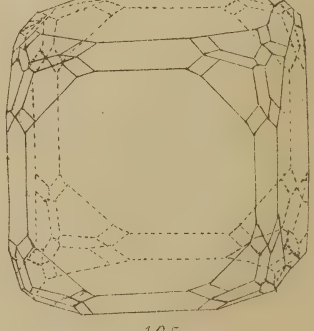

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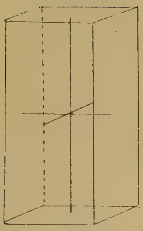
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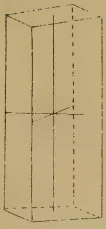
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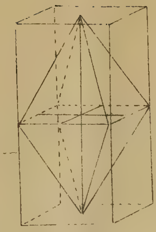
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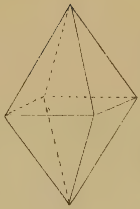
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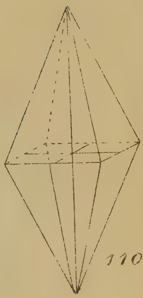
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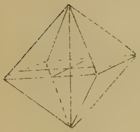
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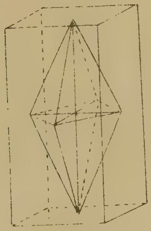
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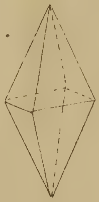
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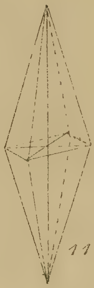
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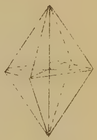
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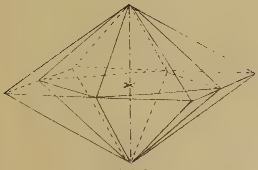
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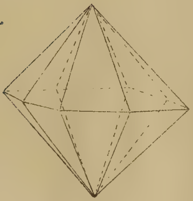
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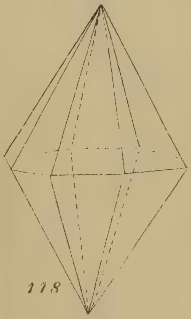
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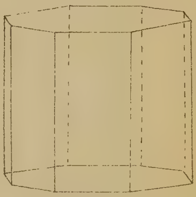
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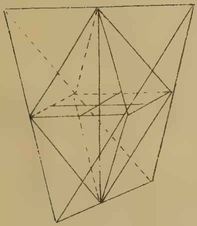
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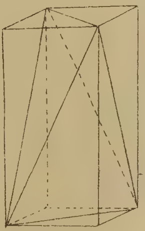
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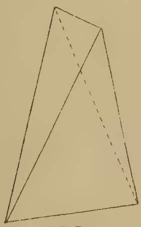
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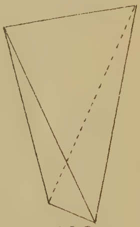
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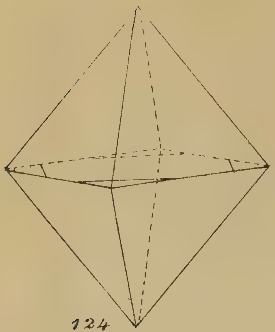
Pl. 10.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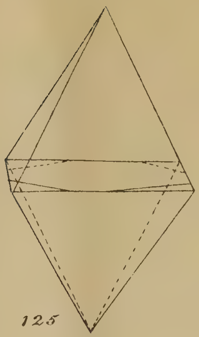
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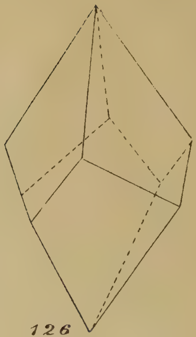
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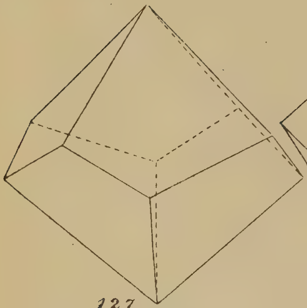
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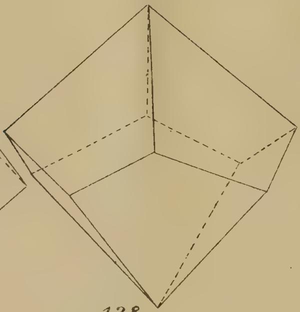
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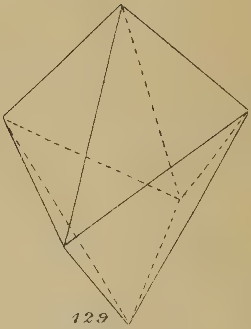
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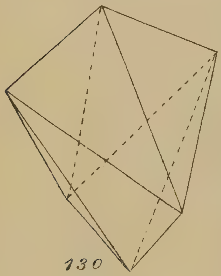
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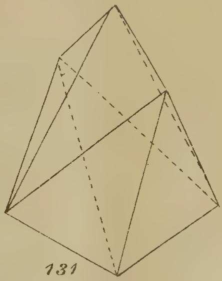
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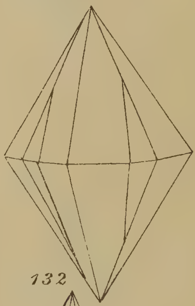
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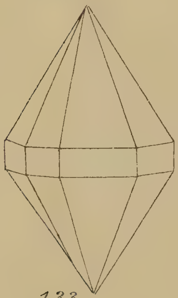
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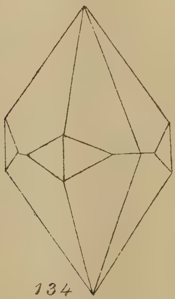
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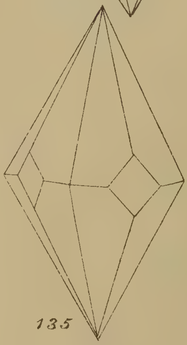
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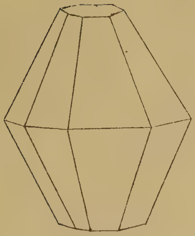

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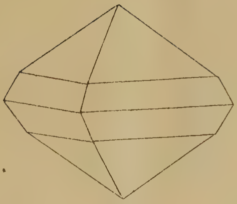

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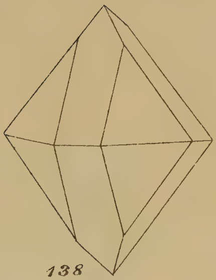

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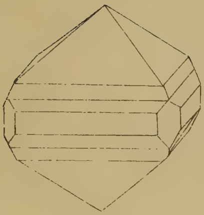

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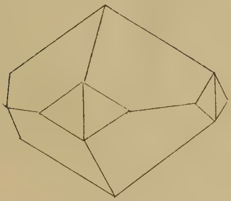

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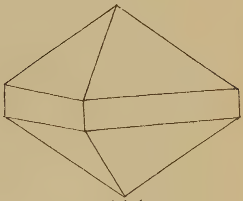

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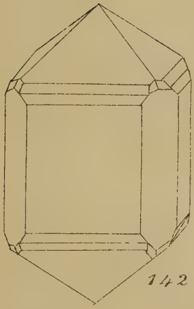

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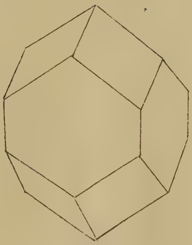

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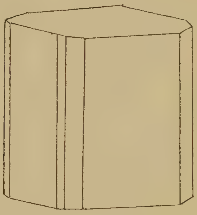

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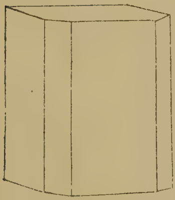

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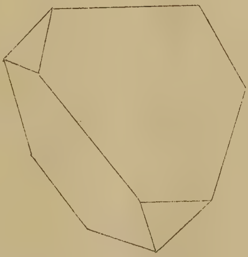

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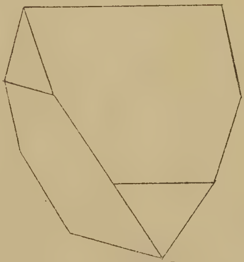

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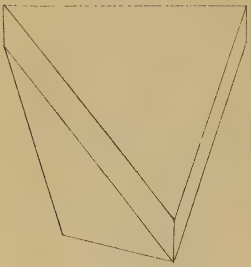
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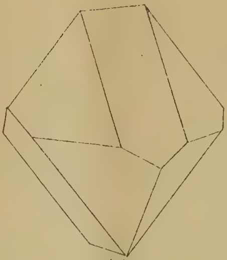
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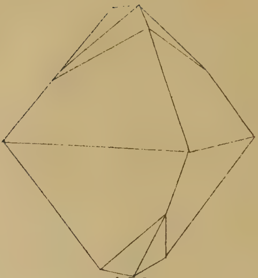
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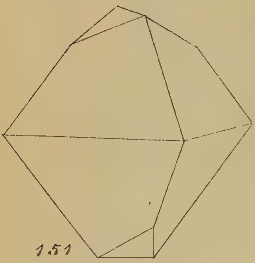
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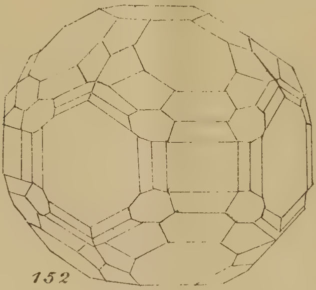
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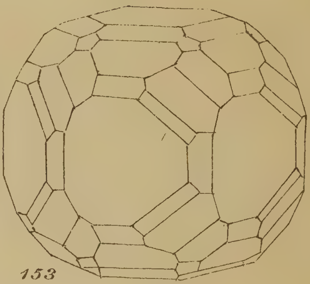
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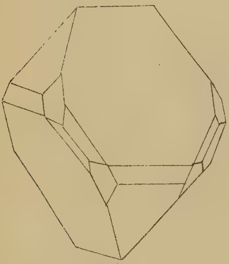
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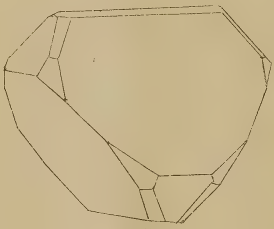
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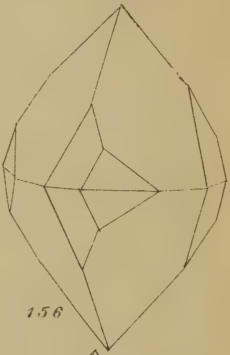
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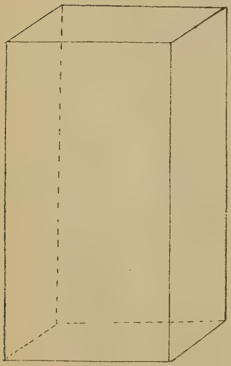
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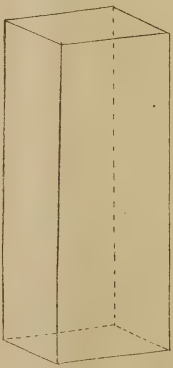
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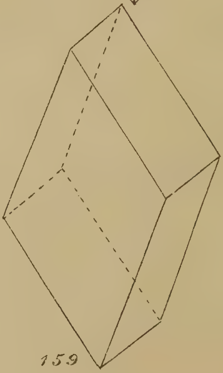
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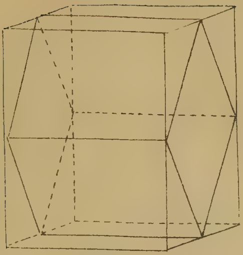
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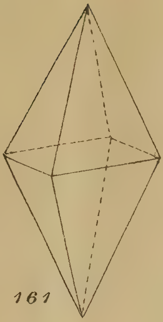
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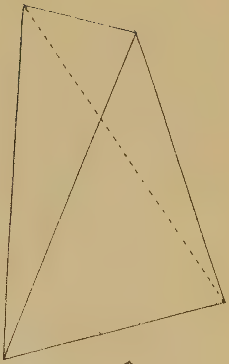
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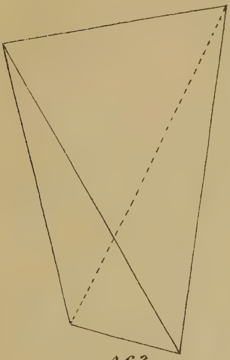
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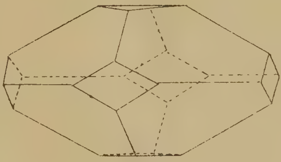
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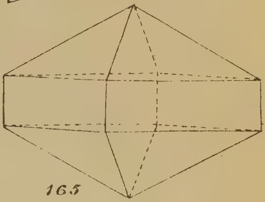
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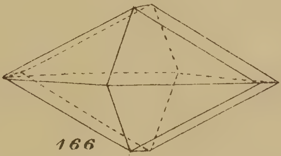
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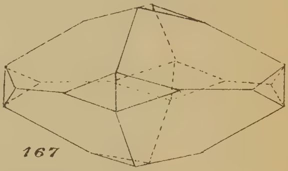
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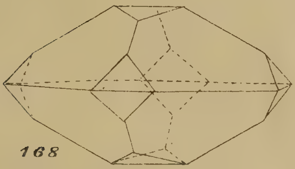
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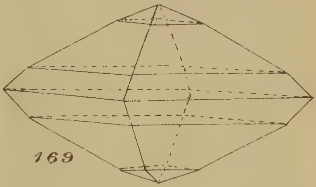
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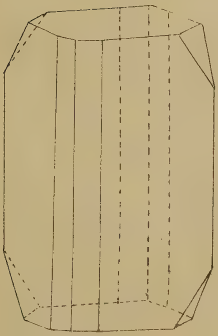
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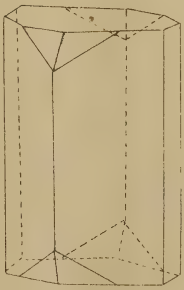
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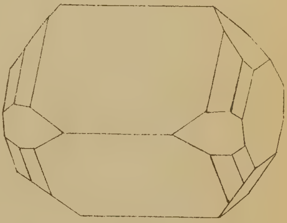
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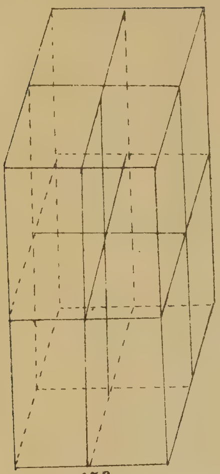
Pl. 14.



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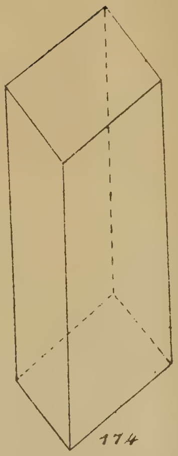

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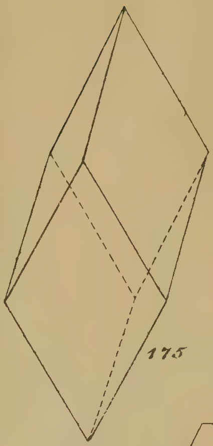

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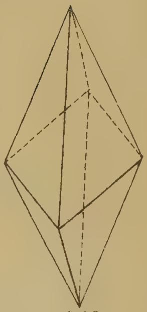

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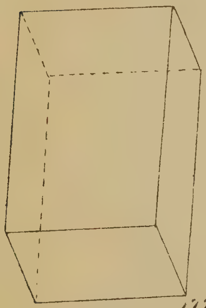

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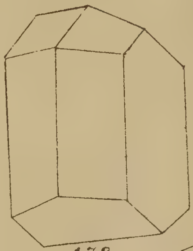

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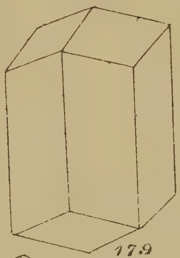

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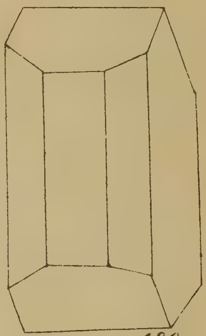

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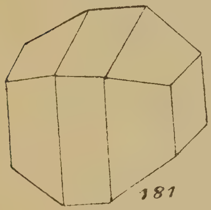

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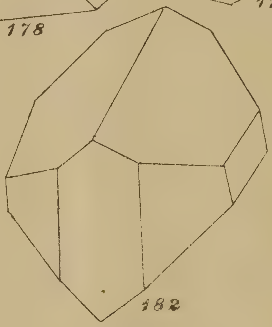

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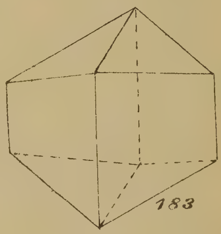

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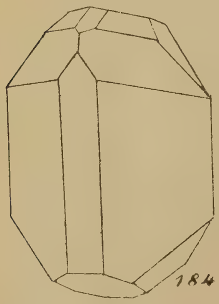

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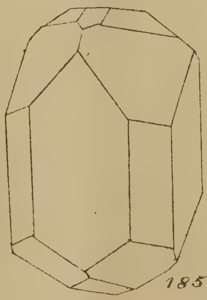

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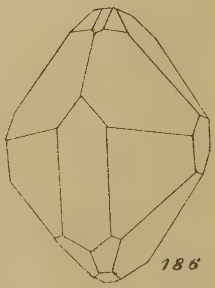

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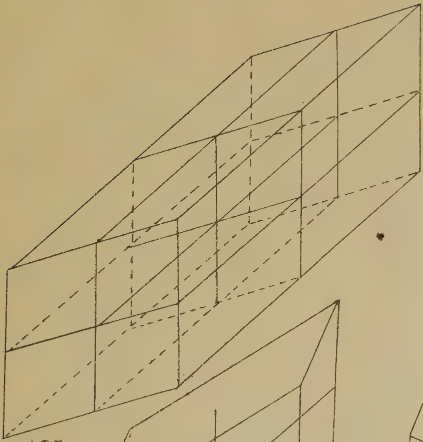

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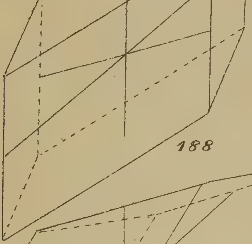

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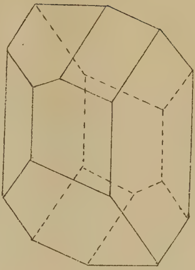

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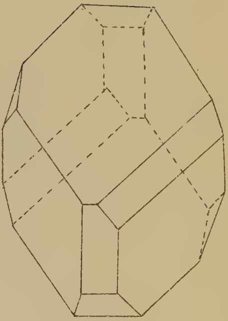

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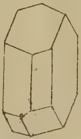

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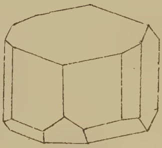

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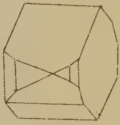

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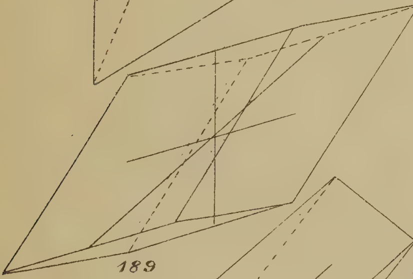

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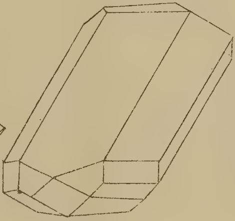

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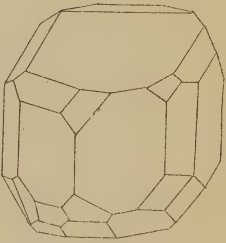

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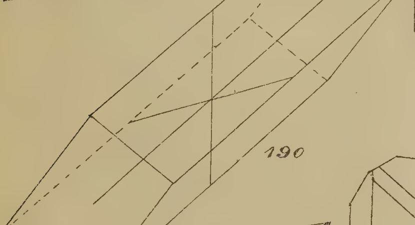

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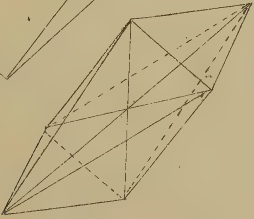

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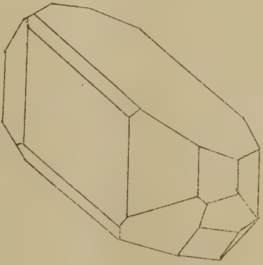

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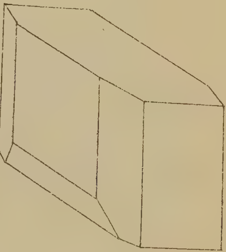

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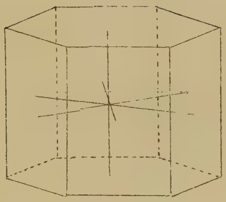
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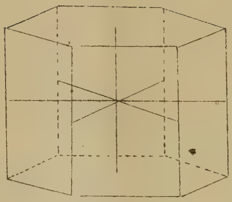
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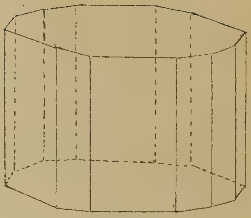
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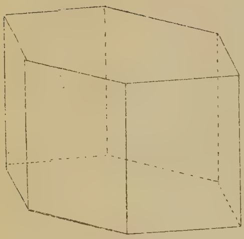
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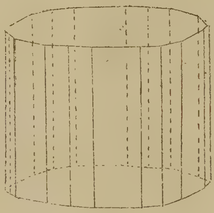
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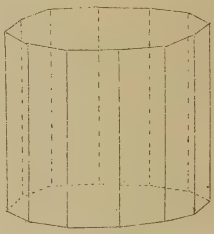
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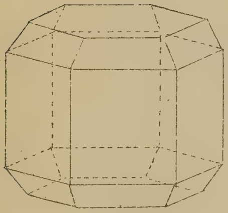
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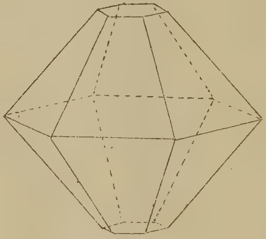
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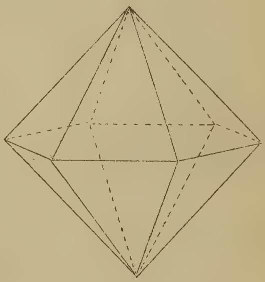
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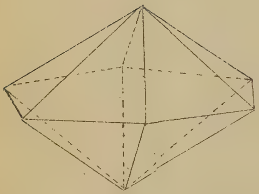
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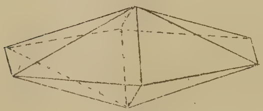
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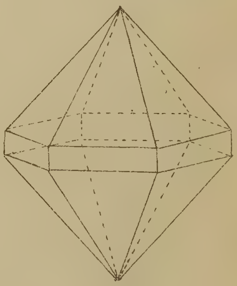
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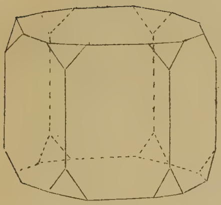
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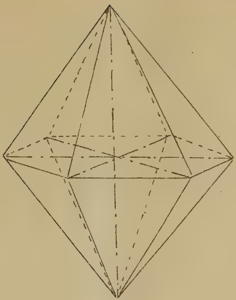
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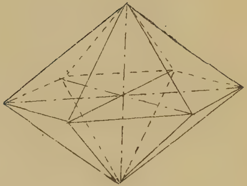
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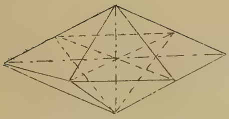
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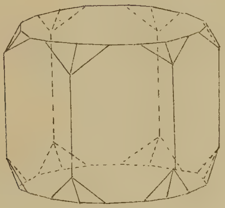
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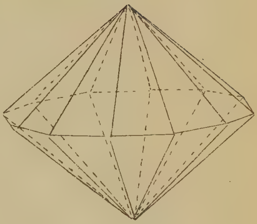
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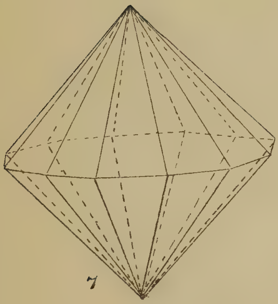
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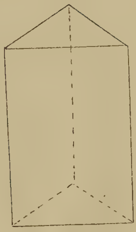
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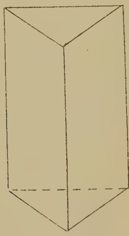
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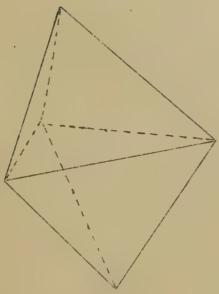
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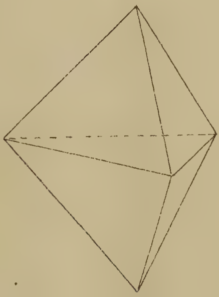
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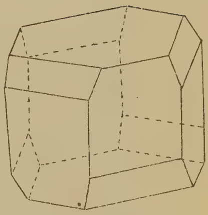
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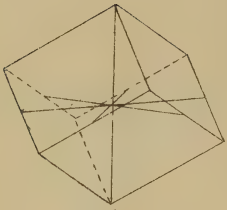
Pl.18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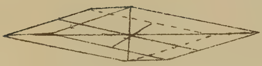
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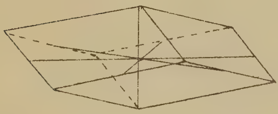
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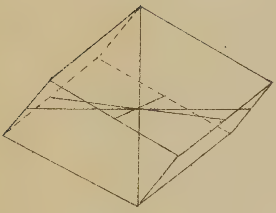
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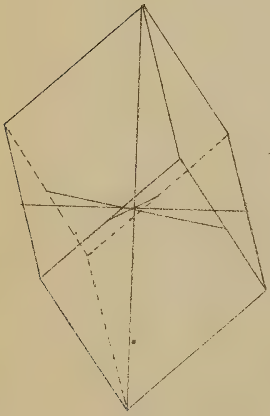
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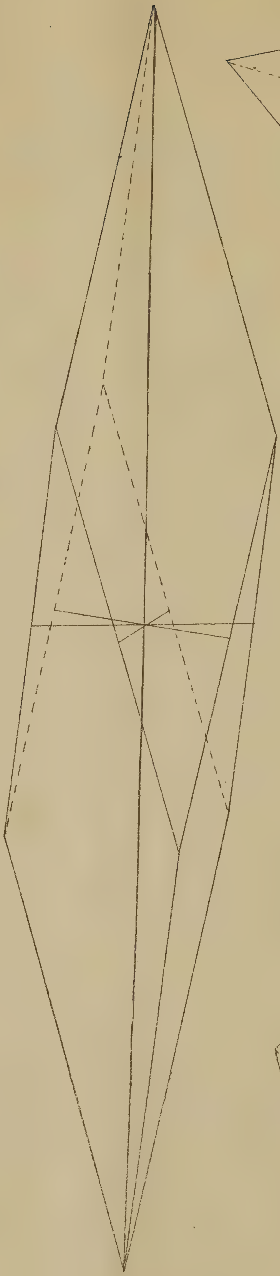
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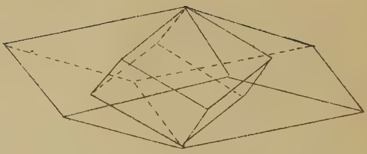
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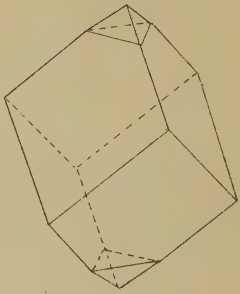
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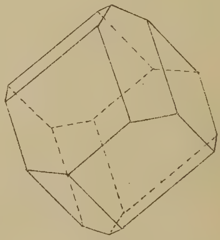
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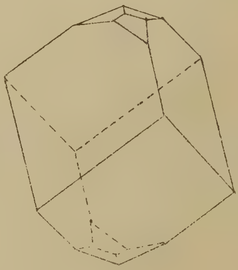
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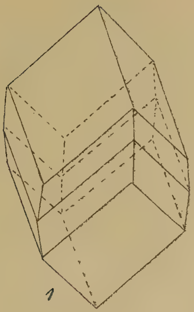
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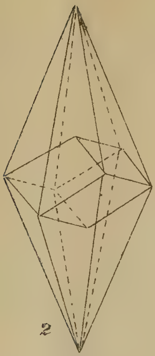
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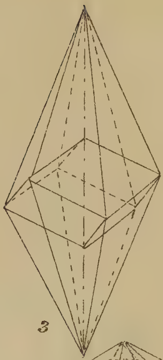
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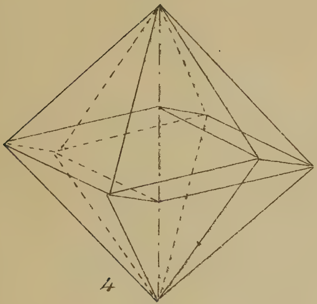
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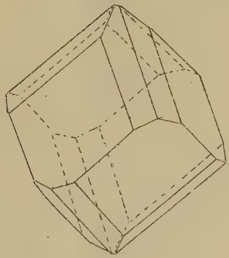
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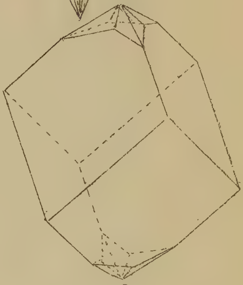
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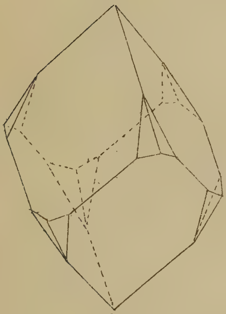
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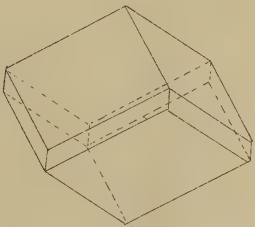
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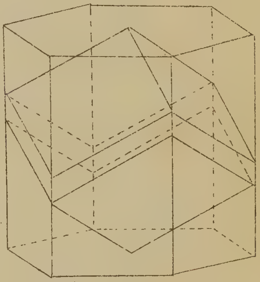
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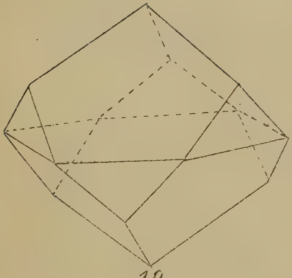
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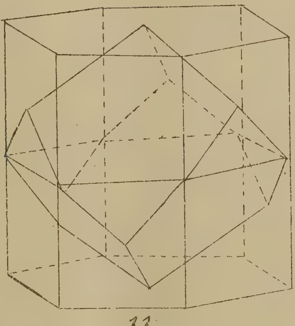
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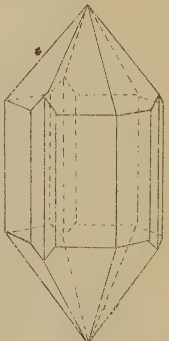
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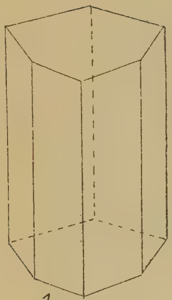
Pl. 20.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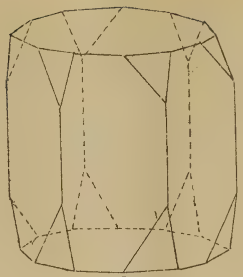
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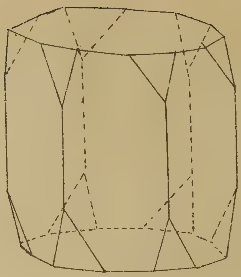
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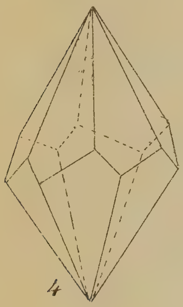
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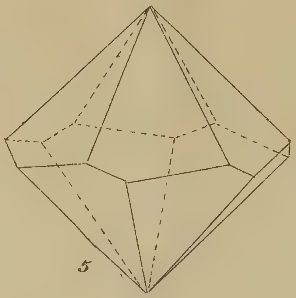
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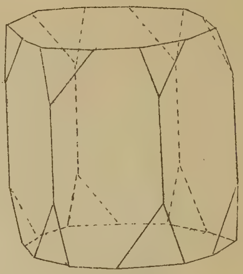
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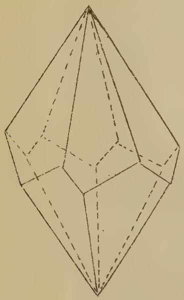
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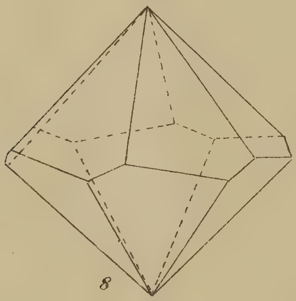
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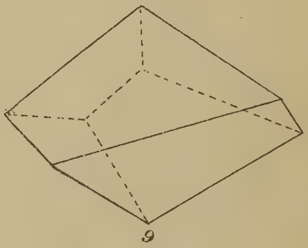
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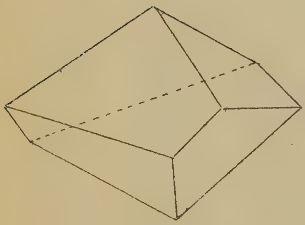
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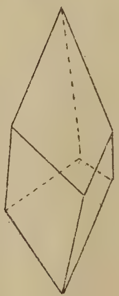
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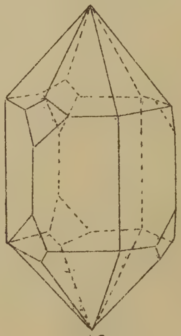
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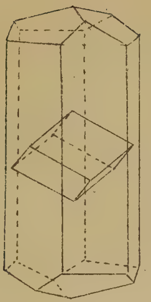
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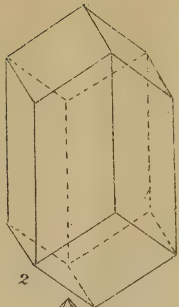
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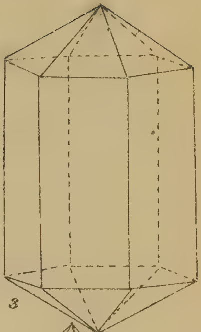
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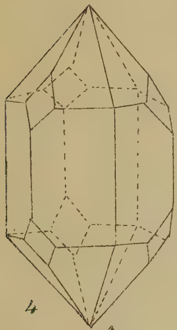
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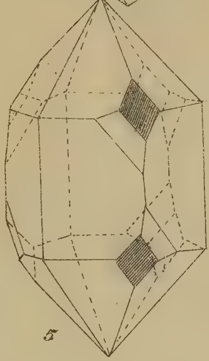
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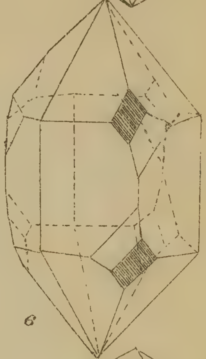
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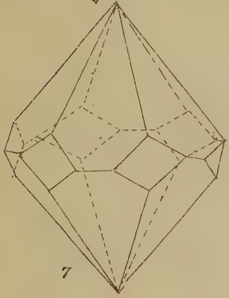
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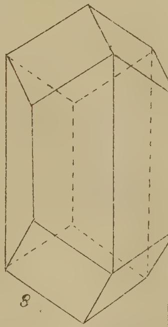
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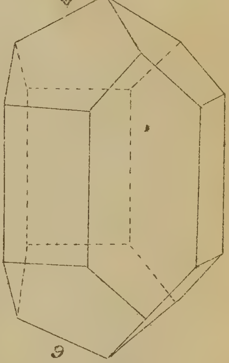
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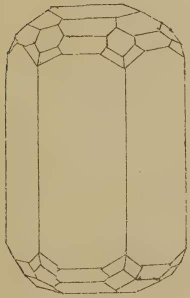
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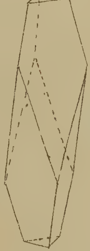
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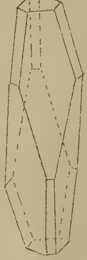
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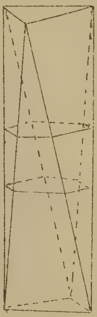
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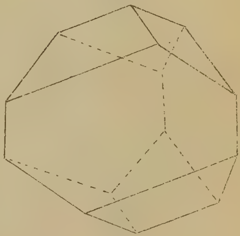
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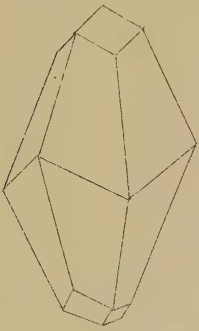
Pl.22.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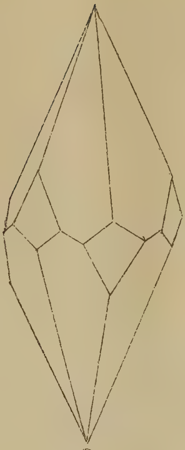
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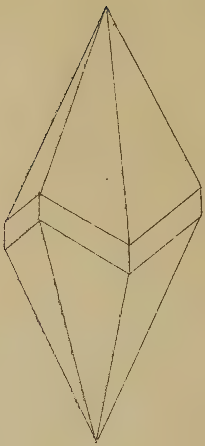
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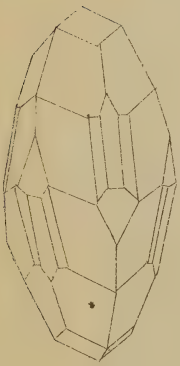
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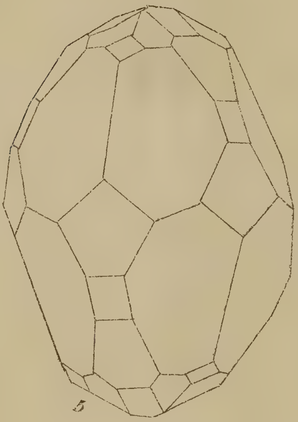
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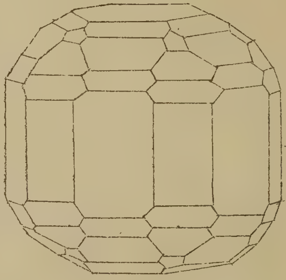
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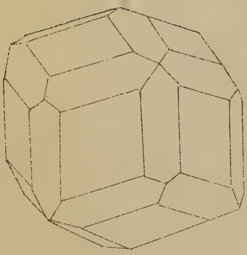
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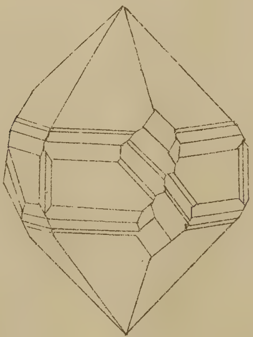
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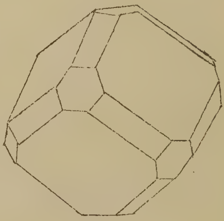
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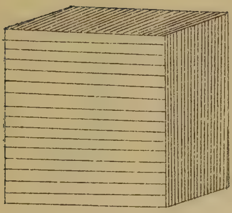
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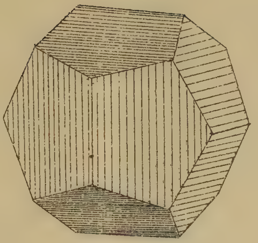
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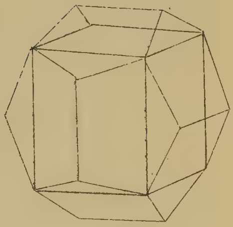
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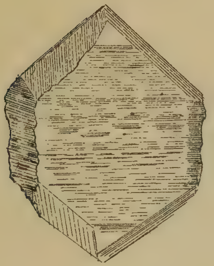
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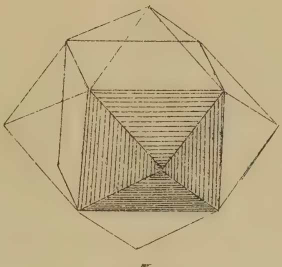
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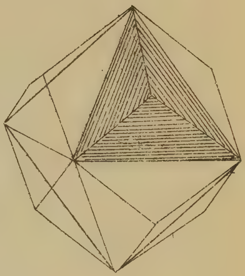
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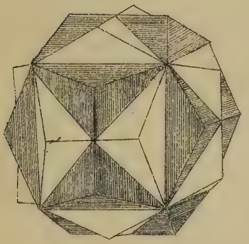
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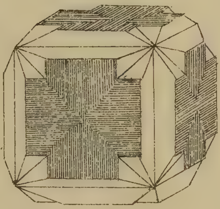
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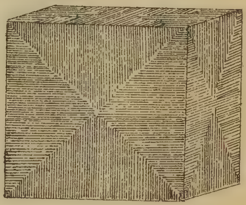
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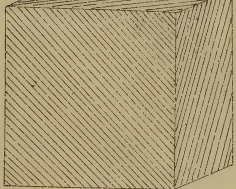
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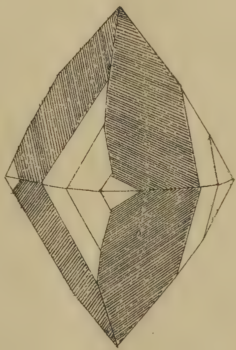
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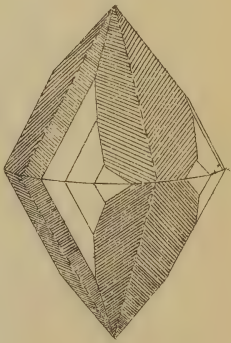
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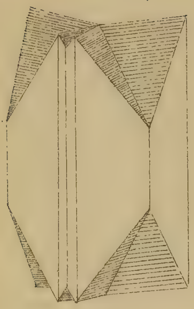
Pl.24.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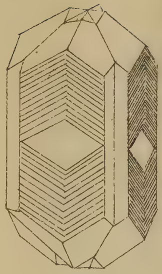
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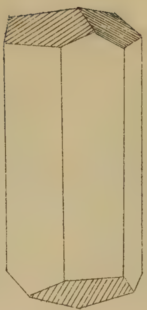
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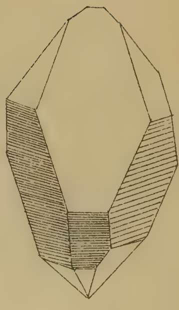
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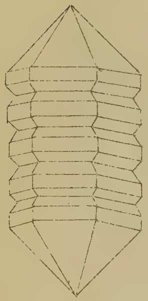
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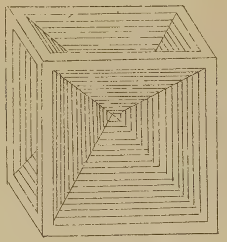
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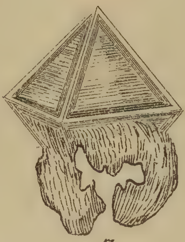
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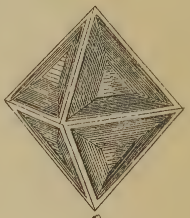
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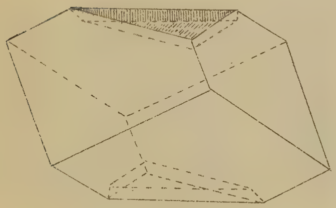
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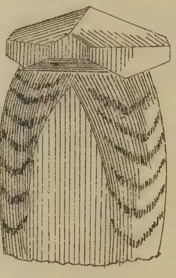
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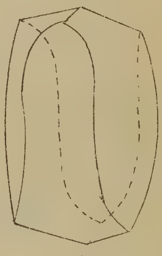
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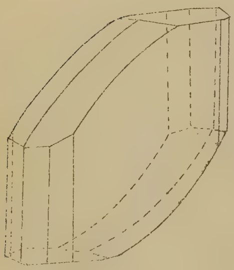
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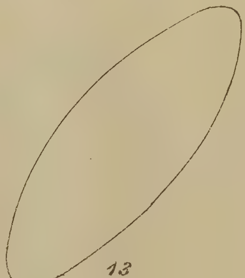
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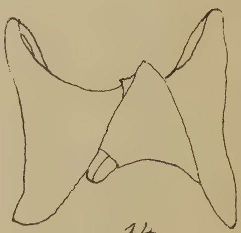
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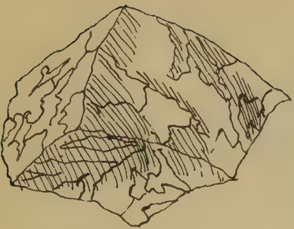
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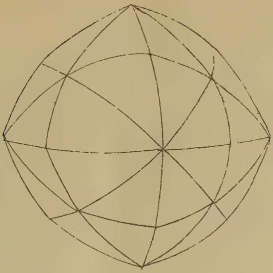
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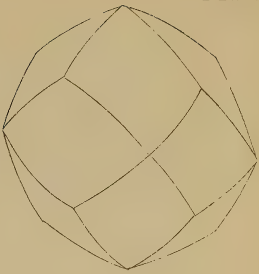
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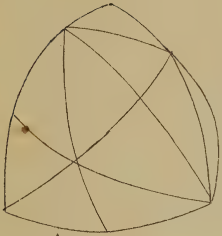
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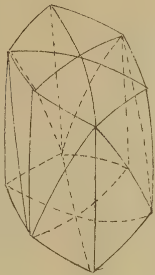
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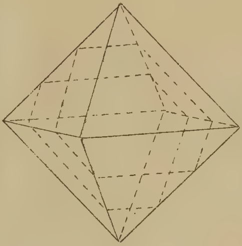
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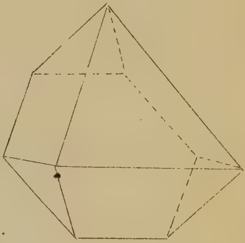
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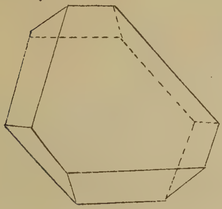
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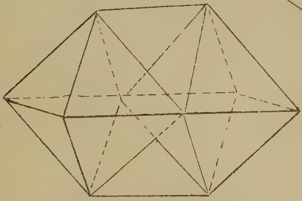
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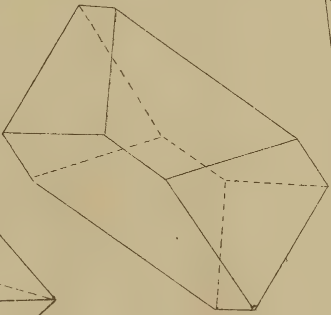
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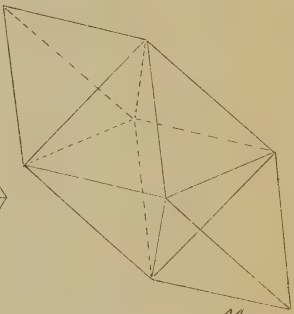
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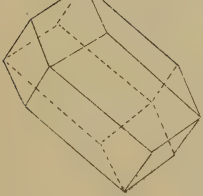
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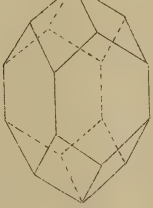
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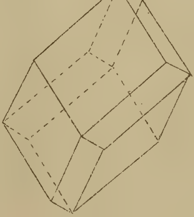
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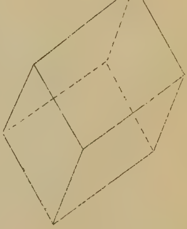
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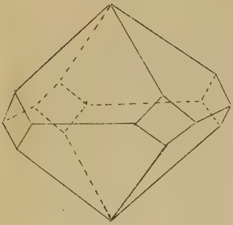
Pl. 26.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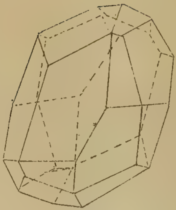
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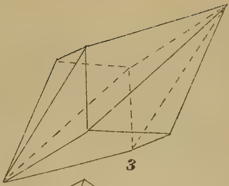
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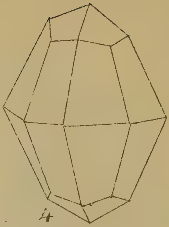
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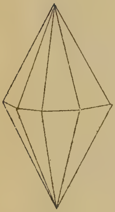
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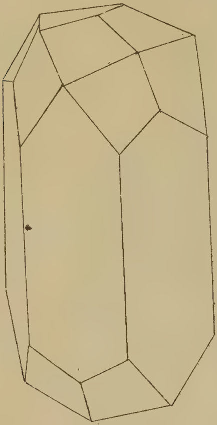
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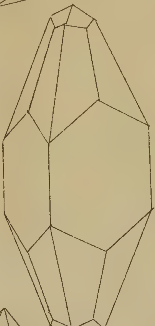
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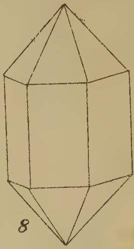
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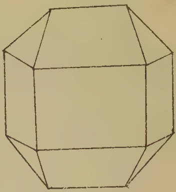
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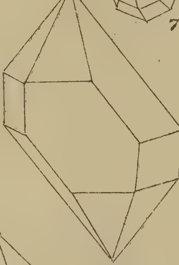
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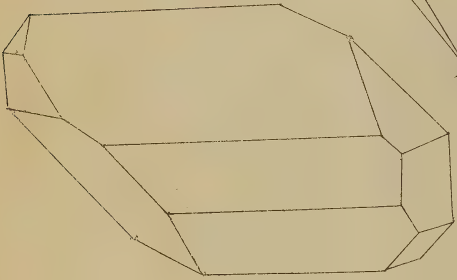
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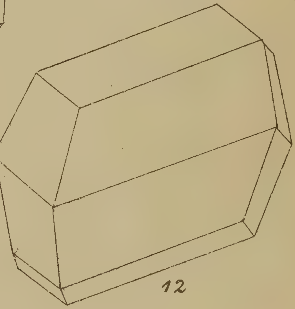
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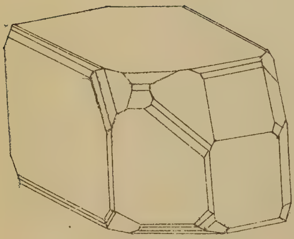
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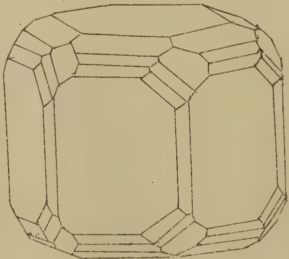
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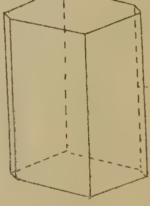
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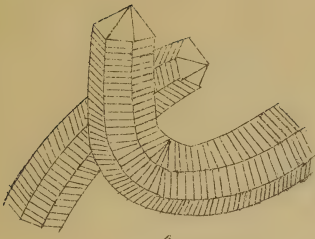

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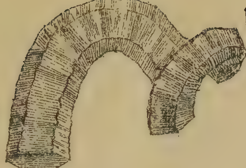

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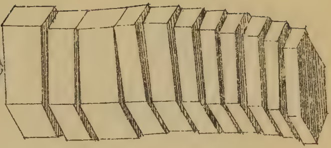

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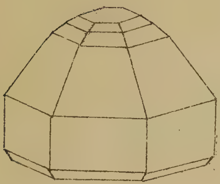

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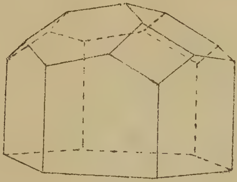

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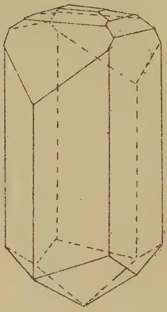

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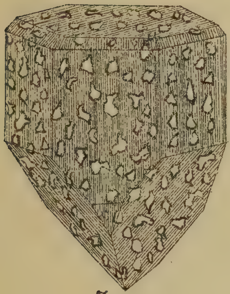

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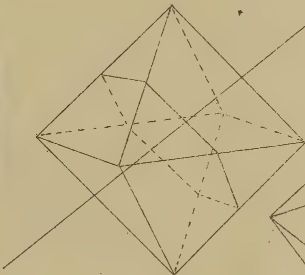

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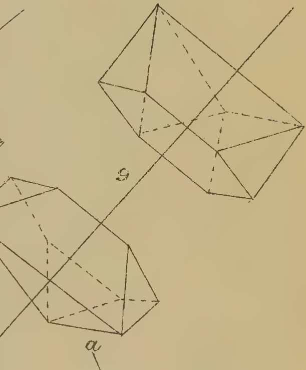

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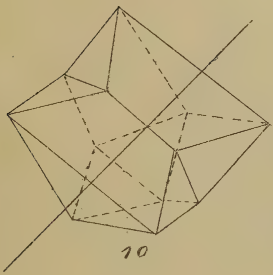

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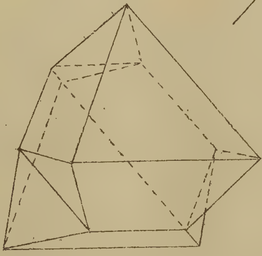

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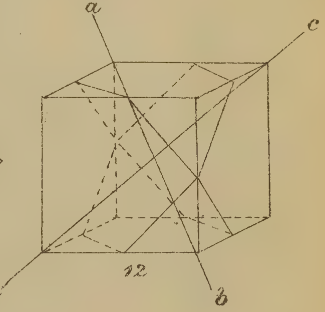

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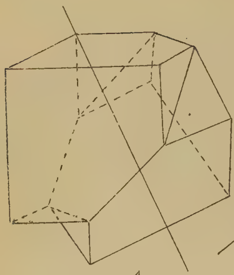
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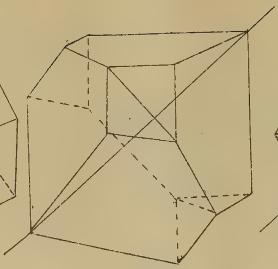
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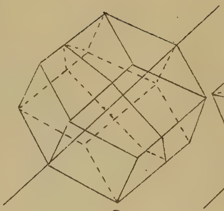
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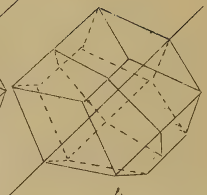
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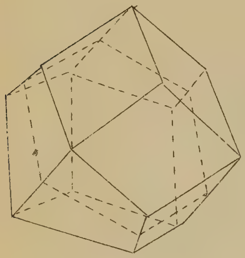
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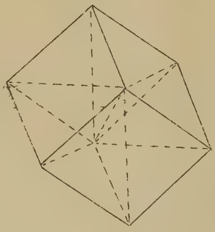
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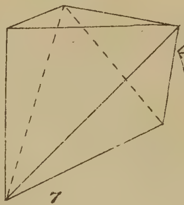
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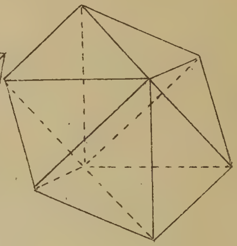
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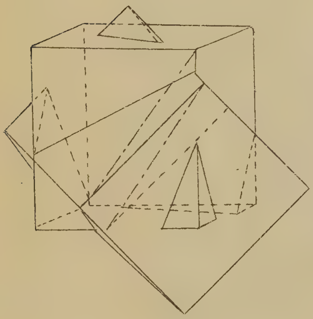
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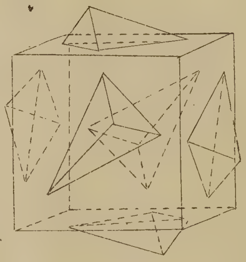
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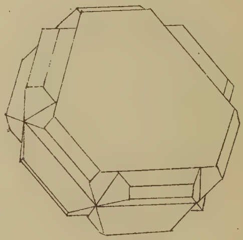
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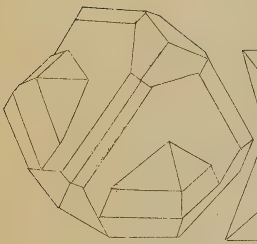
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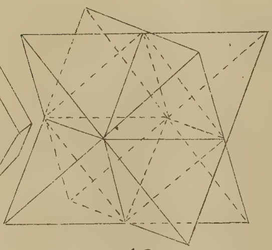
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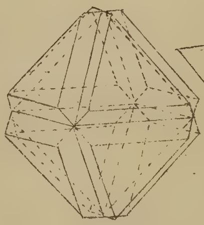
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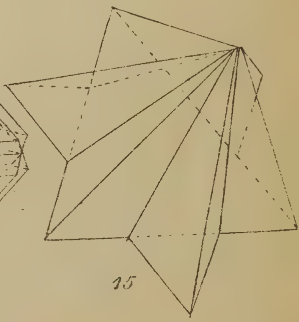
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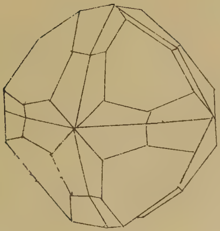

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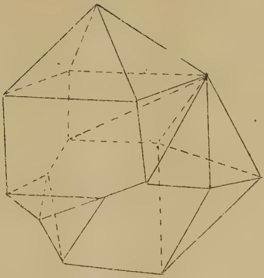

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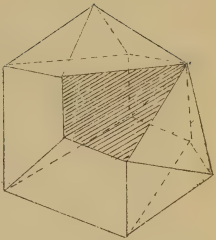

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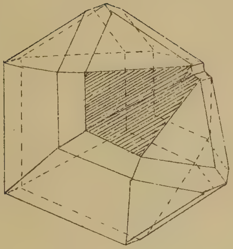

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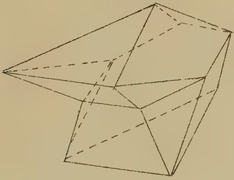

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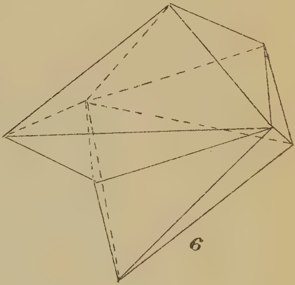

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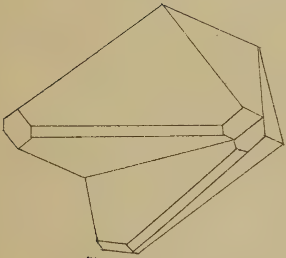

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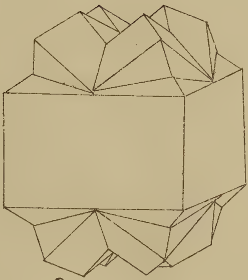

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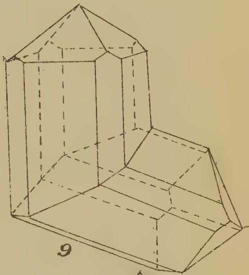

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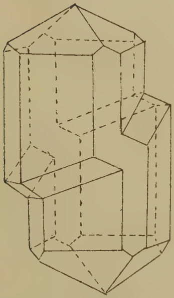

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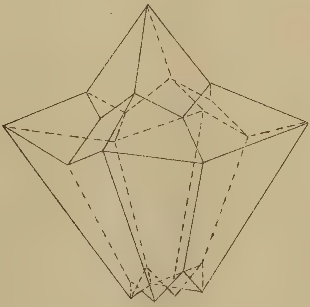

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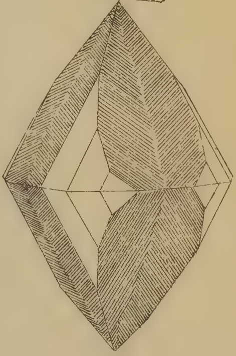

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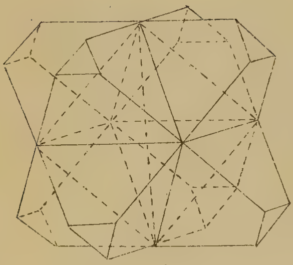
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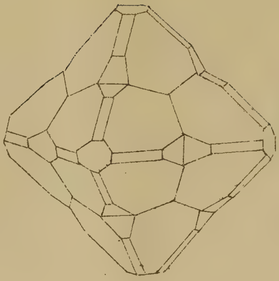
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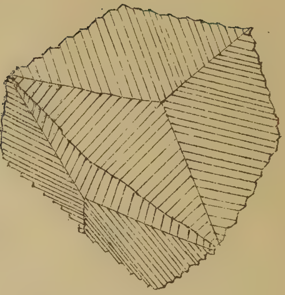
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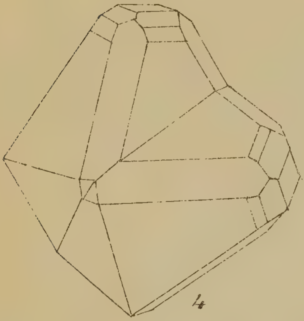
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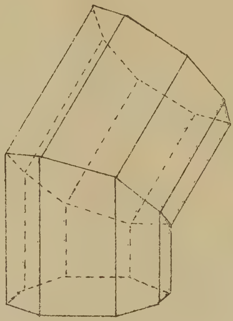
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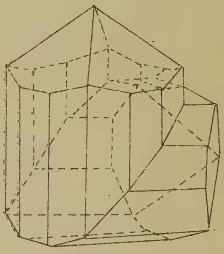
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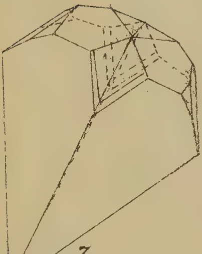
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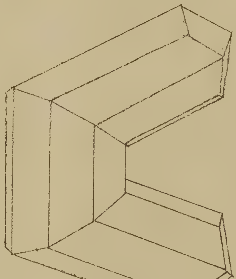
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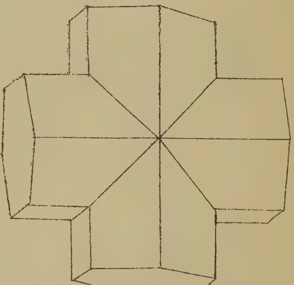
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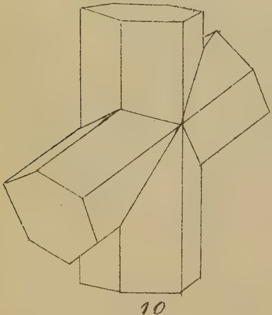
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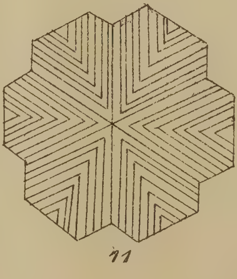
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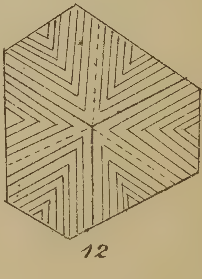
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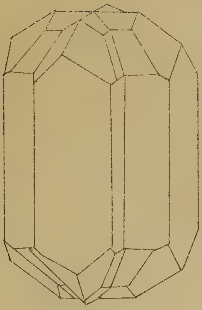
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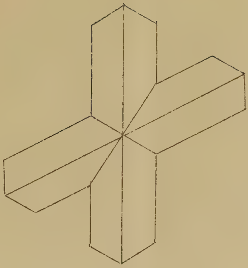
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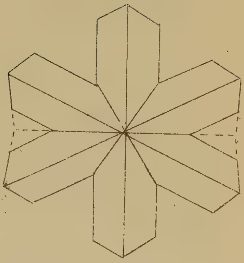
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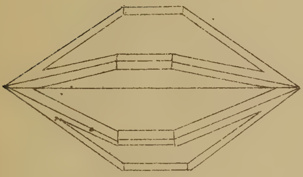
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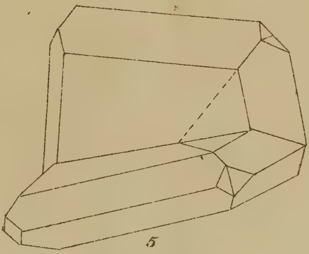
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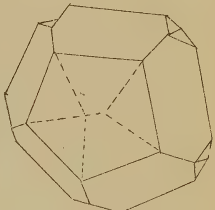
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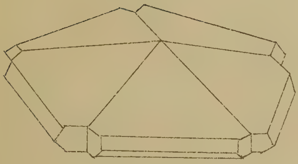
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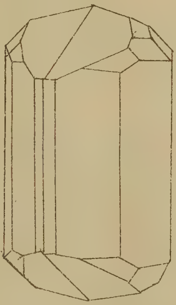
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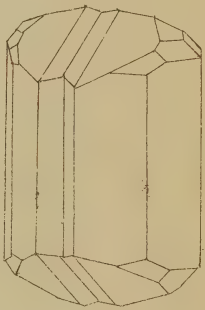
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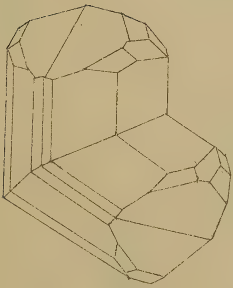
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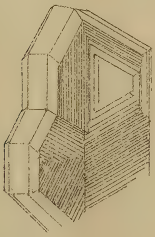
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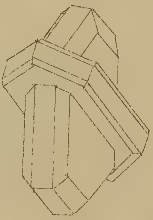
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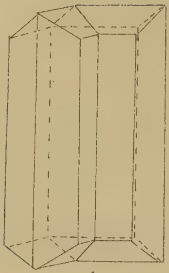
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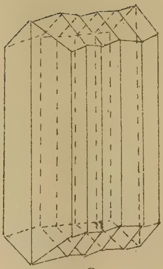
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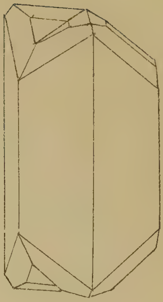
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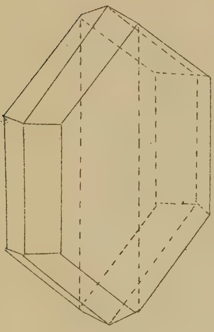
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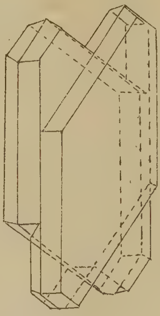
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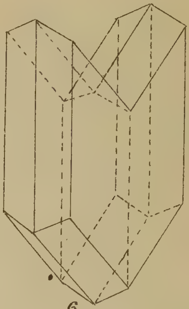
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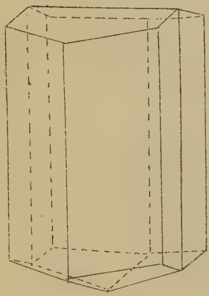
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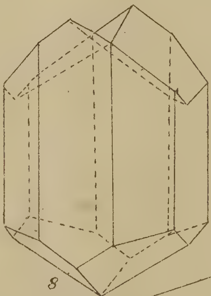
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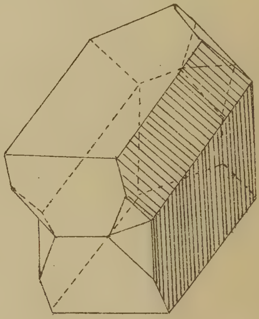
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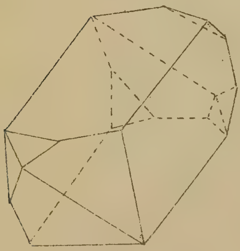
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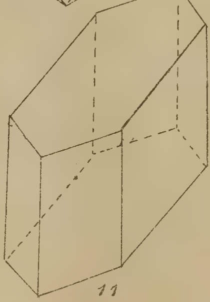
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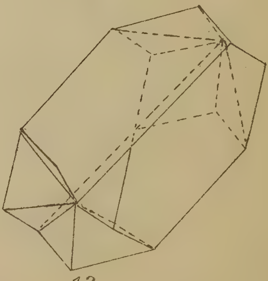
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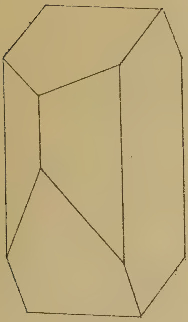
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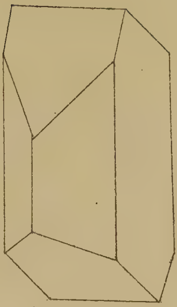
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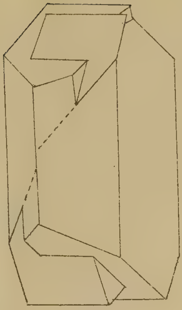
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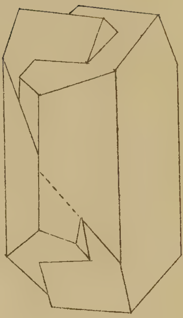
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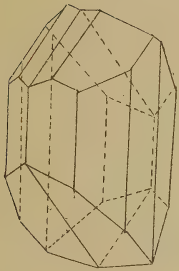
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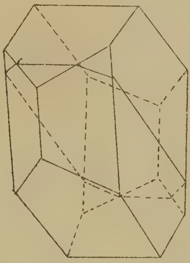
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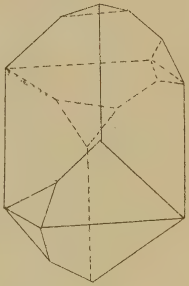
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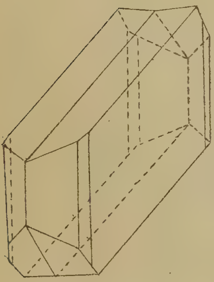
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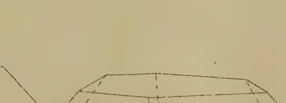
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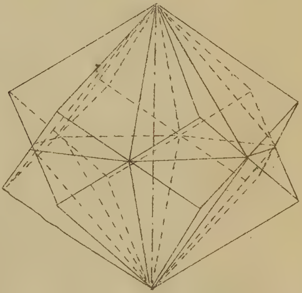
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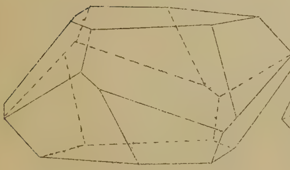
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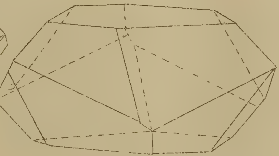
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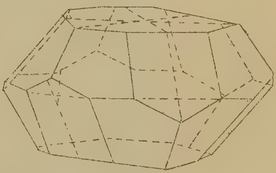
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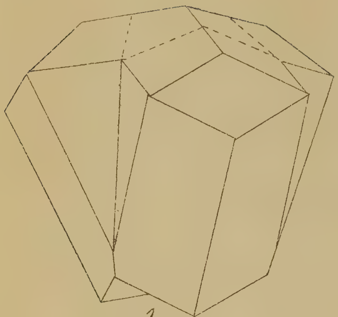

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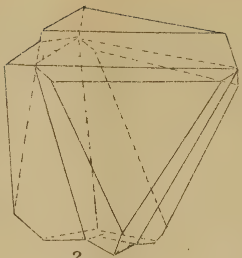

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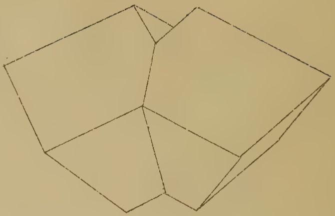

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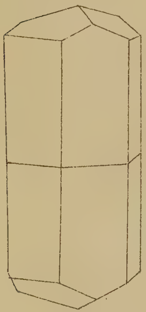

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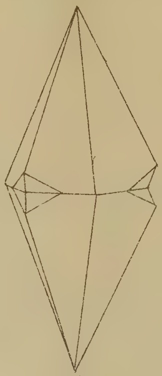

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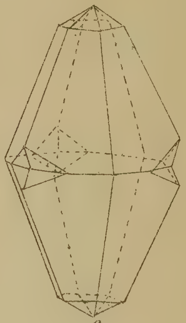

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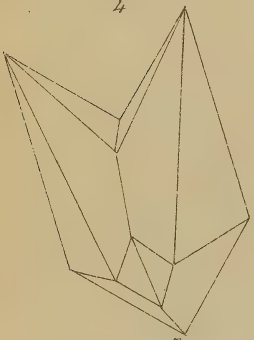

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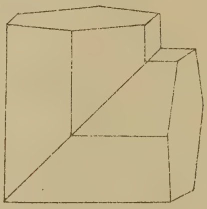

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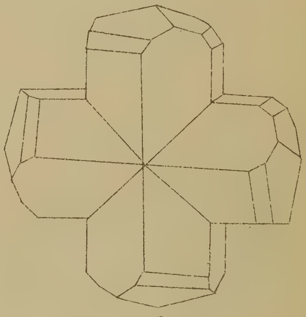

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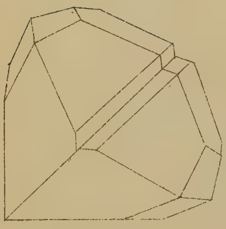

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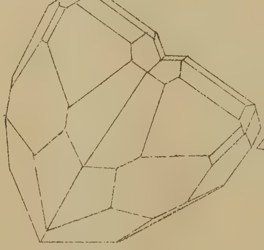

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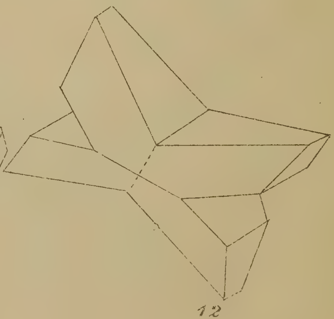

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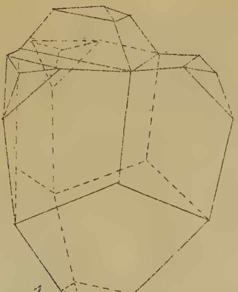
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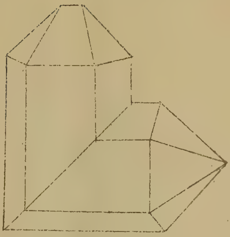
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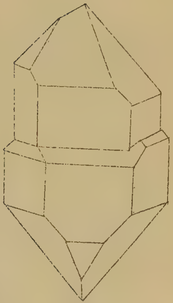
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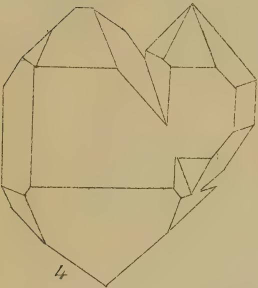
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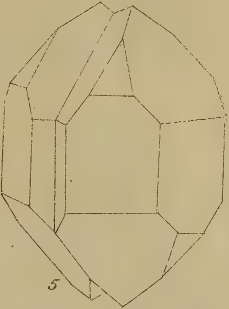
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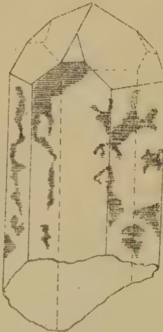
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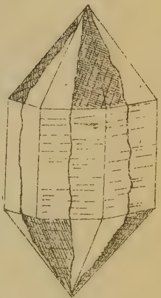
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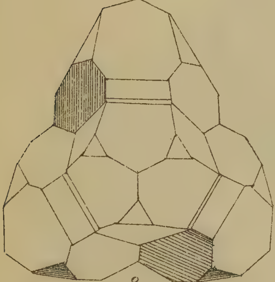
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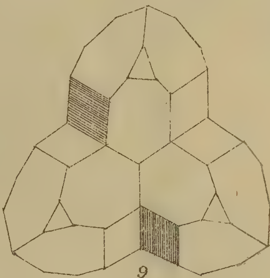
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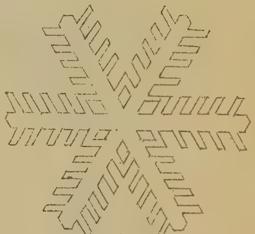
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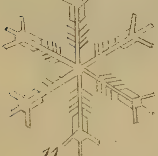
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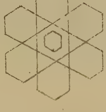
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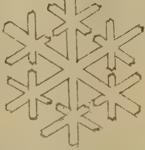
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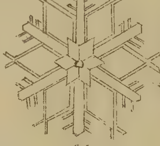
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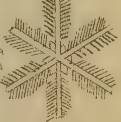
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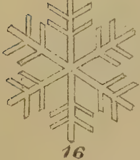
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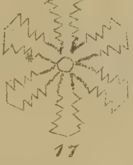
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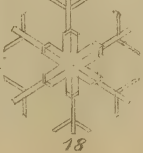
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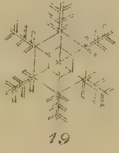
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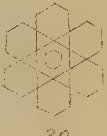
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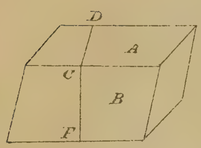

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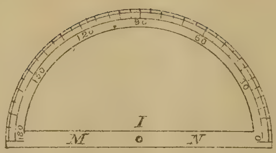

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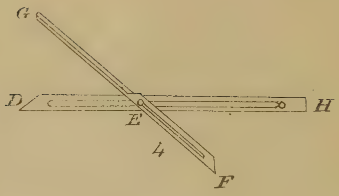

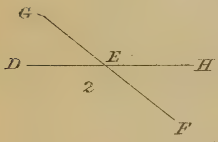

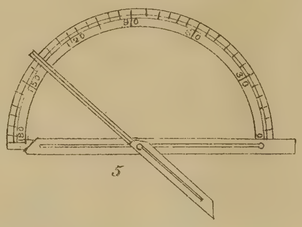

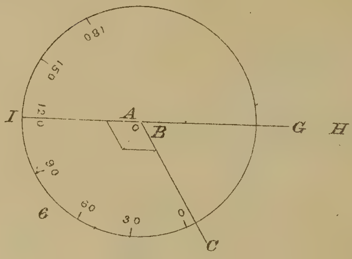

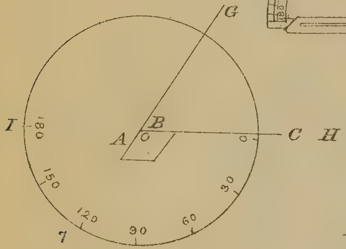

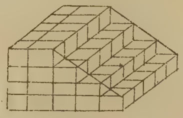

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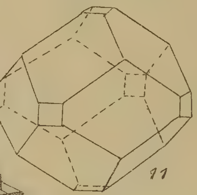

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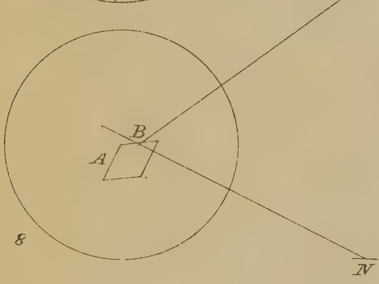

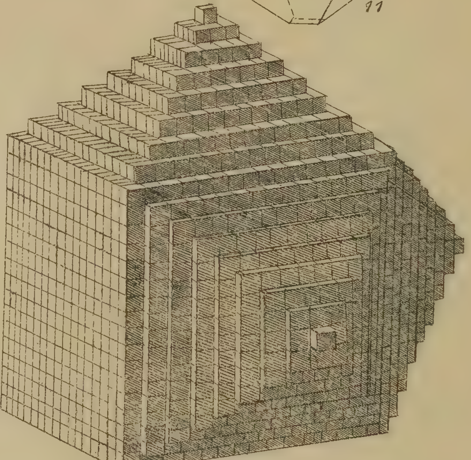

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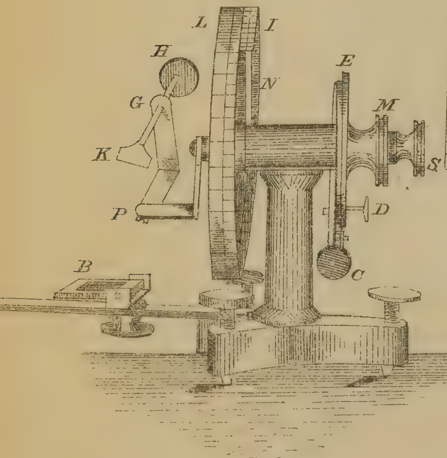

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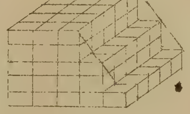

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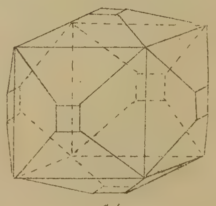

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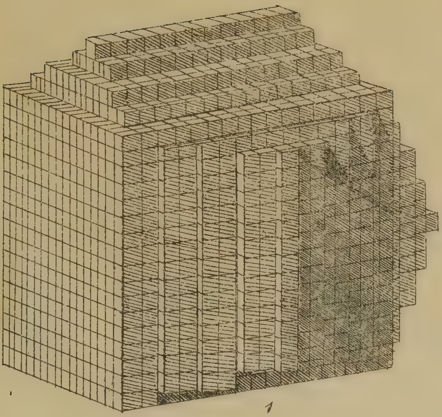
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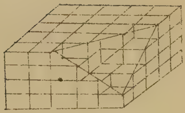
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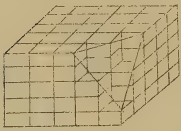
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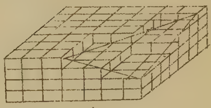
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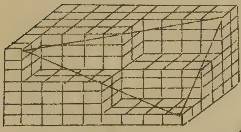
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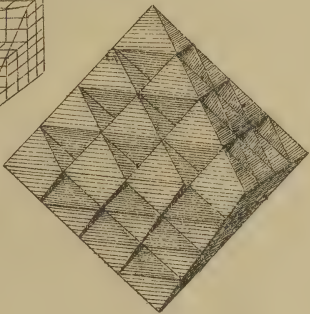
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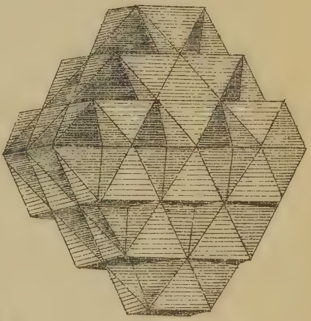
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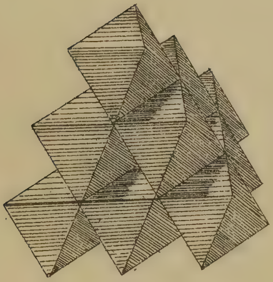
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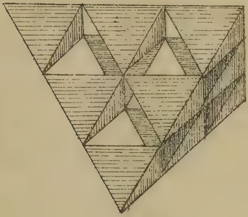
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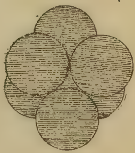
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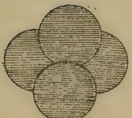
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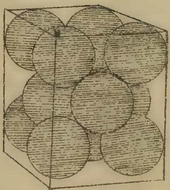
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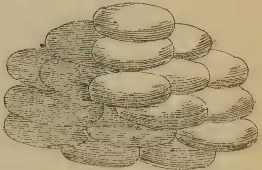
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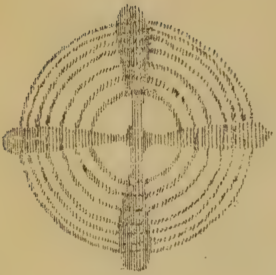

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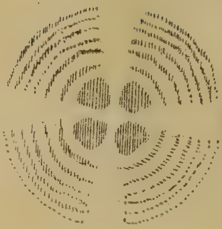

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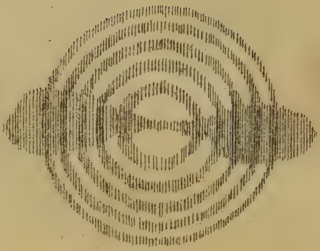

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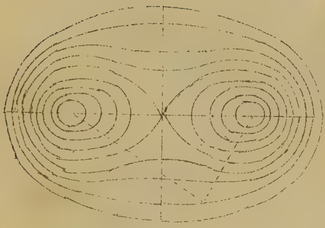

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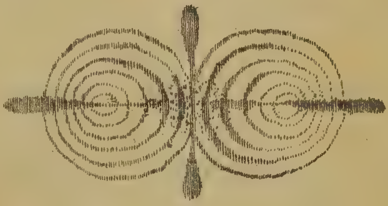

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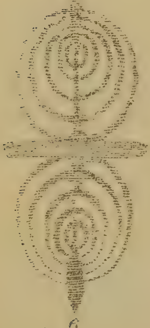

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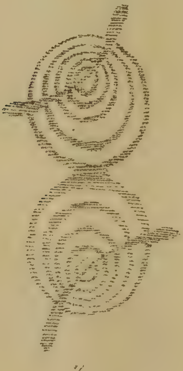

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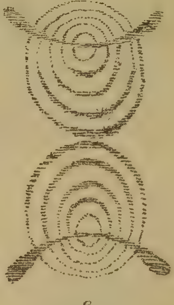

8

COMPARISON OF NOTATIONS

USED TO REPRESENT THE

FACES

OF

CRYSTALS.

COMPILED BY

T. EGLESTON,

Professor of Mineralogy and Metallurgy.

SCHOOL OF MINES COLUMBIA COLLEGE

NEW YORK.

1871.

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T. EGLESTON,
Prof. of Mineralogy and Metallurgy

SCHOOL OF MINES,
COLUMBIA COLLEGE,
1871.

COMPARISON OF NOTATIONS USED TO

ISOMETRIC

REGULAR

HOLOHEDRAL

	LEVY.
Octahedron,	a^1
Cube or hexahedron,	p
Rhombic dodecahedron,	b^1
Tetrahexahedron,	b^m
Trigonal trisoctahedron,	$a^{\frac{1}{m}}$
Tetragonal trisoctahedron,	a^m
Hexoctahedron,	$b^1\ b^{\frac{1}{m}}\ b^{\frac{1}{n}}$

HEMIHEDRAL

Hemi-octahedron, or tetrahedron,	a^1
Hemi-tetrahexahedron, or pentagonal dodecahedron,	b^m
Hemi-trigonal trisoctahedron,	$a^{\frac{1}{m}}$
Hemi-tetragonal trisoctahedron,	a^m
Hemi-hexoctahedron inclined,	$b^1\ b^{\frac{1}{m}}\ b^{\frac{1}{n}}$
Hemi-hexoctahedron parallel, or diploid,	$b^1\ b^{\frac{1}{m}}\ b^{\frac{1}{n}}$
Hemi-hexoctahedron parallel, or gyroid,	$b^1\ b^{\frac{1}{m}}\ b^{\frac{1}{n}}$

TETARTOHEDRAL

Tetarto-hexoctahedron, or tetartoid.	$b^1\ b^{\frac{1}{m}}\ b^{\frac{1}{n}}$

REPRESENT THE FACES OF CRYSTALS.

SYSTEM.

OCTAHEDRON.

FORMS.

MILLER.	WEISS.	NAUMANN.	DANA.
111	a : a : a	O	1
100	a : ∞a : ∞a	∞O∞	*O*
110	a : a : ∞a	∞O	*i or I*
h k o	a : na : ∞a	∞On	*in*
h h k	a : a : ma	mO	*m*
h k k	a : ma : ma	mOm	*mm*
h k l	a : ma : na	mOn	*mn*

FORMS.

$\pm\varkappa$ (111)	$\frac{1}{2}$rl (a : a : a)	$\pm\frac{O}{2}$	$\pm\frac{1}{2}$
$\pm\pi$ (h k o)	$\frac{1}{2}$rl (a : na : ∞a)	$\pm\frac{\infty On}{2}$	$\pm\frac{in}{2}$
$\pm\varkappa$ (h h k)	$\frac{1}{2}$rl (a : a : ma)	$\pm\frac{mO}{2}$	$\pm\frac{m}{2}$
$\pm\varkappa$ (h k k)	$\frac{1}{2}$rl (a : ma : ma)	$\pm\frac{mOm}{2}$	$\pm\frac{mm}{2}$
$\pm\varkappa$ (h k l)	$\frac{1}{2}$rl (a : ma : na)	$\pm\frac{mOn}{2}$	$\pm\frac{mn}{2}$
$\pm\pi$ (h k l)	$\frac{1}{2}$rl (a : ma : na)	$\pm\left[\frac{mOn}{2}\right]$	$\pm\left[\frac{mn}{2}\right]$
$\pm\pi\varkappa$ (h k l)	$\frac{1}{2}$rl (a : ma : na)	$\pm\left(\frac{mOn}{2}\right)$	$\pm\left(\frac{mn}{2}\right)$

FORMS.

$\pi\varkappa$ (h k l)		±r *or* l $\frac{mOn}{4}$	±r *or* l $\frac{mn}{4}$

TETRAGONAL

TETRAGONAL

HOLOHEDRAL

	LEVY.
Tetragonal pyramid of the first order,†	$a^{\frac{1}{m}}$
Tetragonal pyramid of the second order,	$b^{\frac{1}{m}}$
Ditetragonal pyramid,	$b^{\frac{1}{m}}\ b^{\frac{1}{n}}\ h^1$
Tetragonal prism of the first order,†	h^1
Tetragonal prism of the second order,	m
Ditetragonal prism,	$h^{\frac{1}{m}}$
Basal pinacoid,	p

HEMIHEDRAL

Sphenoid of the first order,	$a^{\frac{1}{m}}$
Sphenoid of the second order,	$b^{\frac{1}{m}}$
Tetragonal scalenohedron,	$b^{\frac{1}{m}}\ b^{\frac{1}{n}}\ h^1$
Tetragonal trapezohedron,	$b^{\frac{1}{m}}\ b^{\frac{1}{n}}\ h^1$
Tetragonal pyramid of the third order,	$b^{\frac{1}{m}}\ b^{\frac{1}{n}}\ h^1$
Tetragonal prism of the third order,	$h^{\frac{1}{m}}$

TETARTOHEDRAL

Sphenoid of the third order,

---

* r stands for right and l for left, to distinguish it

† These prisms and pyramids or octahedra of the first order

SYSTEM.

PYRAMID.

FORMS.

MILLER.	WEISS.	NAUMANN.	DANA.
h h l	a : a : mc	mP	*m*
h o l	a : ∞a : mc	mP∞	*mi*
h k l	ma : na : c	mPn	*mn*
110	a : a : ∞c	∞P	*i or 1*
100	a : ∞a : ∞c	∞P∞	*ii*
h k o	a : na : ∞c	∞Pn	*in*
001	∞a : ∞a : c	0P	*O*

FORMS.

$\varkappa$ (h h l)	r.l.$\frac{1}{2}$ (a : a : mc)	$\pm\frac{mP}{2}$	$\pm\frac{m}{2}$
$\varkappa$ (h o l)	r.l.$\frac{1}{2}$ (a : ∞a : mc)	$\pm\frac{mP\infty}{2}$	$\pm\frac{mi}{2}$
$\varkappa$ *or* $\varkappa'$ (h k l)	r.l.$\frac{1}{2}$ (ma : na : c)	$\pm\frac{mPn}{2}$	$\pm\frac{mn}{2}$
$\varkappa''$ (h k l)	r.l.$\pm\frac{1}{2}$ (ma : na : c)	*r *or* 1 $\frac{mPn}{2}$	r *or* 1 $\frac{mn}{2}$
π (h k l)	$\frac{r}{1}.\frac{1}{r}.\frac{1}{2}$ (ma : na : c)	$\frac{r}{1}$ *or* $\frac{1}{r}$ $\frac{mPn}{2}$	$\frac{r}{1}$ *or* $\frac{1}{r}$ $\frac{mn}{2}$
(h k o)	r.l.$\frac{1}{2}$ (a : na : ∞c)	$\frac{r}{1}$ *or* $\frac{1}{r}$ $\frac{\infty Pn}{2}$	$\frac{r}{1}$ *or* $\frac{1}{r}$ $\frac{in}{2}$

FORMS.

$\pm\pi\varkappa$ (h k l)		$\pm\frac{r}{1}$ *or* $\frac{1}{r}\frac{mPn}{4}$	$\pm\frac{r}{1}$ *or* $\frac{1}{r}$ $\frac{mn}{4}$

from + right, and — left, in the previous forms.

are those of the second in the diagrams.

ORTHORHOMBIC

RHOMBIC

HOLOHEDRAL

	LEVY.
Rhombic pyramid,	$b^{\frac{1}{m}}$
Macropyramid,	$b^{\frac{1}{m}}\ b^{\frac{1}{n}}\ g^1$
Brachypyramid,	$b^{\frac{1}{m}}\ b^{\frac{1}{n}}\ g^1$
Rhombic prism,	m
Macroprism,	$h^{\frac{1}{m}}$
Brachyprism,	$g^{\frac{1}{m}}$
Macrodome,	$a^{\frac{1}{m}}$
Brachydome,	$e^{\frac{1}{m}}$
Macropinacoid,	h^1
Brachypinacoid,	g^1
Basal pinacoid,	p

HEMIHEDRAL

Rhombic sphenoid.	

The other hemihedral forms are single

SYSTEM.

PYRAMID.

FORMS.

MILLER.	WEISS.	NAUMANN.	DANA.
h h l	a : b : mc	mP	*m*
* h k l	na : b : mc	$m\bar{P}n$	$m\bar{n}$
† h k l	a : nb : mc	$m\breve{P}n$	$m\breve{n}$
110	a : b : ∞c	∞P	*i or I*
*h k o	na : b : ∞c	$\infty\bar{P}n$	$i\bar{n}$
†h k o	a : nb : ∞c	$\infty\breve{P}n$	$i\breve{n}$
o k l	∞a : b : mc	$m\bar{P}\infty$	$m\bar{i}$
h o l	a : ∞b : mc	$m\breve{P}\infty$	$m\breve{i}$
010	∞a : b : ∞c	$\infty\bar{P}\infty$	$i\bar{i}$
100	a : ∞b : ∞c	$\infty\breve{P}\infty$	$i\breve{i}$
001	∞a : ∞b : c	0P	*O*

FORMS.

ϰ (h k l)	{ na : b : mc a : nb : mc	r *or* l $\frac{m\breve{\bar{P}}n}{2}$	r *or* l $\frac{m\breve{\bar{n}}}{2}$

planes, or pairs of parallel planes.

* h < k   † h > k

MONOCLINIC

MONOCLINIC

HOLOHEDRAL

		LEVY.
Monoclinic pyramid,	Hemi-pyramid,	$d^{\frac{1}{m}}$
	Hemi-pyramid,	$b^{\frac{1}{m}}$
Orthopyramid,	Hemi-orthopyramid,	$b^{\frac{1}{m}}\ d^{\frac{1}{n}}\ h^1$
	Hemi-orthopyramid,	$b^{\frac{1}{m}}\ b^{\frac{1}{n}}\ h^1$
Clinopyramid,	Hemi-clinopyramid,	$d^{\frac{1}{m}}\ b^{\frac{1}{n}}\ g$
	Hemi-clinopyramid,	$b^{\frac{1}{m}}\ d^{\frac{1}{n}}\ g^1$
Inclined rhombic prism,		m
Orthoprism,		$h^{\frac{1}{m}}$
Clinoprism,		$g^{\frac{1}{m}}$
Orthodome,	Hemi-orthodome,	$o^{\frac{1}{m}}$
	Hemi-orthodome,	$a^{\frac{1}{m}}$
Clinodome,		$e^{\frac{1}{m}}$
Orthopinacoid,		h^1
Clinopinacoid,		g^1
Basal pinacoid,		p

The hemihedral forms are single planes or pairs of parallel planes.

SYSTEM.

PYRAMID.

FORMS.

MILLER.	WEISS.	NAUMANN.	DANA.
h k k	a : b : mc	$\pm$mP	$\pm m$
$\bar{\text{h}}$ k k	a′ : b : mc		
* h k l	a : nb : mc	$\pm$ m$\bar{\text{P}}$n	$\pm m\bar{n}$
* h k l	a′ : nb : mc		
† h k l	na : b : mc	$\pm$mP̆n	$\pm m\breve{n}$
† $\bar{\text{h}}$ k l	na′ : b : mc		
110	a : b : ∞c	∞P	*i or 1*
*h k o	a : nb : ∞c	$\infty\bar{\text{P}}$n	$i\bar{n}$
†h k o	na : b : ∞c	∞P̆n	$i\breve{n}$
h o l	a : ∞b : mc	$\pm$ m$\bar{\text{P}}\infty$	$\pm m\bar{i}$
$\bar{\text{h}}$ o l	a′ : ∞b : mc		
o k l	∞a : b : mc	mP̆∞	$m\breve{i}$
100	a : ∞b : ∞c	$\infty\bar{\text{P}}\infty$	$i\bar{i}$
010	∞a : b : ∞c	∞P̆∞	$i\breve{i}$
001	∞a : ∞b : c	0P	*0*

* h > k. † h < k.

TRICLINIC

TRICLINIC

HOLOHEDRAL

		LEVY.
Triclinic pyramid,	Tetarto-pyramid,	$f^{\frac{1}{2}}$
	Tetarto-pyramid,	$d^{\frac{1}{2}}$
	Tetarto-pyramid,	$b^{\frac{1}{2}}$
	Tetarto-pyramid,	$c^{\frac{1}{2}}$
Macropyramid,	Tetarto-pyramid,	$f^{\frac{1}{m}}\ d^{\frac{1}{n}}\ h^1$
	Tetarto-pyramid,	$d^{\frac{1}{m}}\ f^{\frac{1}{n}}\ h^1$
	Tetarto-pyramid,	$b^{\frac{1}{m}}\ c^{\frac{1}{n}}\ h^1$
	Tetarto-pyramid,	$c^{\frac{1}{m}}\ h^{\frac{1}{m}}\ h^1$
Brachypyramid,	Tetarto-pyramid,	$f^{\frac{1}{m}}\ c^{\frac{1}{n}}\ g^1$
	Tetarto-pyramid,	$d^{\frac{1}{m}}\ b^{\frac{1}{m}}\ g^1$
	Tetarto-pyramid,	$b^{\frac{1}{m}}\ d^{\frac{1}{n}}\ g^1$
	Tetarto-pyramid,	$c^{\frac{1}{m}}\ f^{\frac{1}{n}}\ g^1$
Doubly inclined rhombic prism,	Hemi-prism,	t
	Hemi-prism,	m
Macroprism,	Hemi-prism,	$h^{\frac{1}{m}}$
	Hemi-prism.	${}^{\frac{1}{m}}h$
Brachyprism,	Hemi-prism,	$g^{\frac{1}{m}}$
	Hemi-prism,	${}^{\frac{1}{m}}g$
Macrodome,	Hemi-dome,	$o^{\frac{1}{m}}$
	Hemi-dome,	$a^{\frac{1}{m}}$
Brachydome,	Hemi-dome,	$i^{\frac{1}{m}}$
	Hemi-dome,	$e^{\frac{1}{m}}$
Macropinacoid,		h^1
Brachypinacoid,		g^1
Basal pinacoid,		p

* $h > k$ † $< k$

SYSTEM.

PYRAMID.

FORMS.

MILLER.	WEISS.	NAUMANN.		DANA.
111	$a : b : c$	$m'_{,}\ P'_{,}$	mP'	m'
$1\bar{1}1$	$a : b' : c$		$m'P$	$'m$
$\bar{1}\bar{1}1$	$a' : b' : c'$		$mP_{,}$	$m_{,}$
$\bar{1}11$	$a' : b : c$		$m_{,}P$	$_{,}m$
* hkl	$a : nb : mc$	$m'_{,}\ \bar{P}'_{,}\ n$	$m\bar{P}'\ n$	$m'\bar{n}$
* $h\bar{k}l$	$a : nb' : mc$		$m'\bar{P}n$	$'m\bar{n}$
* $\bar{h}\bar{k}l$	$a' : nb' : mc$		$m\bar{P}_{,}n$	$m_{,}\bar{n}$
* $\bar{h}kl$	$a' : nb : mc$		$m\ \bar{P}n$	$_{,}m\bar{n}$
† hkl	$na : b : mc$	$m'_{,}\ \check{P}_{,}\ 'n$	$m\check{P}'\ n$	$m'\breve{n}$
† $h\bar{k}l$	$na : b' : mc$		$m'\check{P}n$	$'m\breve{n}$
† $\bar{h}\bar{k}l$	$na' : b' : mc$		$m\check{P}_{,}n$	$m_{,}\breve{n}$
† $\bar{h}kl$	$na' : b : mc$		$m_{,}\check{P}n$	$_{,}m\breve{n}$
110	$a : b : \infty c$	$\infty'\ P'$	$\infty\ P'$	i' *or* I'
$1\bar{1}0$	$a : b' : \infty c$		$\infty'\ P$	$'i$ *or* $'I$
* hko	$a : nb : \infty c$	$\infty'\ \bar{P}'n$	$\infty\bar{P}'\ n$	$i'\ \bar{n}$
* $\bar{h}ko$	$a' : nb : \infty c$		$\infty'\ P\ n$	$_{,}i\bar{n}$
† hko	$na : b : \infty c$	$\infty'\ \check{P}'\ n$	$\infty\ \check{P}'\ n$	$i'\breve{n}$
† $\bar{h}ko$	$na' : b : \infty c$		$\infty'\ \check{P}\ n$	$'i\breve{n}$
hol	$a\ \infty b : mc$	$m_{,}'\bar{P}_{,}'\ \infty$	$m_{,}\ \bar{P}'\ \infty$	$m_{,}\ '\bar{i}$
$\bar{h}ol$	$a' : \infty b : mc$		$m'\ \bar{P}_{,}\ \infty$	$m'\ _{,}\bar{i}$
okl	$\infty a : b : mc$	$m_{,}\ '\check{P}_{,}'\ \infty$	$m'\ \check{P}'\ \infty$	$m''\ \breve{i}$
$o\bar{k}l$	$a : b' : mc$		$m_{,}\ \check{P}_{,}\ \infty$	$m_{,,}\ \breve{i}$
100	$a : \infty b : \infty c$	$\infty\ \bar{P}\ \infty$		$i\bar{i}$
010	$\infty a : b : \infty c$	$\infty\ \check{P}\ \infty$		$i\breve{i}$
001	$\infty a : \infty b : c$	$0P$		O

HEXAGONAL

HEXAGONAL

HOLOHEDRAL

	LEVY. Hexagonal.
Pyramid of the first order,†	$b^{\frac{1}{m}}$
Pyramid of the second order,	a^1
Dihexagonal pyramid,	b^1 $b^{\frac{1}{n}}$ $b^{\frac{1}{p}}$
Hexagonal prism of the first order,	m
Hexagonal prism of the second order,	h^1
Dihexagonal prism,	$h^{\frac{1}{m}}$
Basal pinacoid,	p

HEMIHEDRAL

Rhombohedron,	$b^{\frac{1}{m}}$
Rhombohedron of the second order,	
Hexagonal scalenohedron,	
Hexagonal trapezohedron,	
Pyramid of the third order,	
Ditrigonal pyramid,	
Trigonal pyramid of the first order,	
Trigonal pyramid of the second order,	
Hexagonal prism of the third order,	
Ditrigonal prism,	
Trigonal prism of the first order,	
Trigonal prism of the second order,	

TETARTOHEDRAL

Rhombohedron of the third order,	
Trigonal trapezohedron (plagihedron),	
Trigonal pyramid of the third order,	

---

† These pyramids and prisms are those of the second in the diagrams.

SYSTEM.

PYRAMID.

FORMS.

MILLER. Rhombohedral.	WEISS. Hexagonal.	NAUMANN. Hexagonal.	NAUMANN. Rhombohedral.	DANA.
100	∞a : a : a : mc	mP	±mR	*m*
h k l	2a : a : 2a : mc	mP2	mP2	*m*2
(h k l) (p q r)	a : na : pa : mc	*mPn	*mPn	**mn*
$2\bar{1}\bar{1}$	∞a : a : a : ∞c	∞P	∞R	*i or I*
$10\bar{1}$	2a : a : 2a : ∞c	∞P2	mR∞	*i*2
h k l	a : na : pa : ∞c	* ∞Pn	* ∞Rn	**in*
001	∞a : a ∞ : ∞a : c	0P	0R	*O*

FORMS.

MILLER. Rhombohedral.	WEISS. Hexagonal.	NAUMANN. Hexagonal.	NAUMANN. Rhombohedral.	DANA.
(h k k) (p q q)	½ (∞a : a . a : mc) ½ (∞a : a′ : a′ : mc)	$\pm\frac{mP}{2}$	±mR	$\pm\frac{m}{2}$
π (h k l)	½(2a : a : 2a : mc) ½(2a′ : a : 2a′ : mc)	$\pm\frac{mP2}{2}$		$\pm\frac{m2}{2}$
(h k l) (p q r)	½ (a : na : pa : mc) ½ (a′ : na′ : pa : mc)	$\pm\frac{mPn}{2}$	± mRn	$\pm\frac{mn}{2}$
α (h k l) (p q r)		$r\ or\ l\ \frac{mPn}{2}$		$r\ or\ l\ \frac{mn}{2}$
± π (h k l) (p q r)		$\frac{r}{l}\ or\ \frac{l}{r}\ \frac{mPn}{2}$		$\frac{r}{l}\ or\ \frac{l}{r}\ \frac{mn}{2}$
		$r\ or\ l\ \left[\frac{mPn}{2}\right]$		$r\ or\ l\left[\frac{mn}{2}\right]$
± ϰ (h k k) ± ϰ (p q q)		$r\ or\ l\ \frac{mP}{2}$		$r\ or\ l\ \frac{m}{2}$
± ϰ (h k l)		$r\ or\ l\ \frac{mP2}{2}$		$r\ or\ l\ \frac{m2}{2}$
π (h k l) (p q r)		$\frac{r}{l}\ or\ \frac{l}{r}\ \frac{\infty Pn}{2}$		$\frac{r}{l}\ or\ \frac{l}{r}\ \frac{in}{2}$
α (h k l) (p q r)		$r\ or\ l\ \left[\frac{\infty Pn}{2}\right]$		$r\ or\ l\ \left[\frac{in}{2}\right]$
		$\pm\frac{\infty P}{2}$		$\pm\frac{i}{2}$
		$\pm\frac{\infty P2}{2}$		$\pm\frac{i2}{2}$

FORMS.

MILLER. Rhombohedral.	WEISS. Hexagonal.	NAUMANN. Hexagonal.	DANA.
± π ϰ (h k l) (p q r)		$\pm\frac{r}{l}\ or\ \frac{l}{r}\ \frac{mPn}{4}$	$\pm\frac{r}{l}\ or\ \frac{l}{r}\ \frac{mn}{4}$
α (h k l)		$\pm\ r\ or\ l\ \frac{mPn}{4}$	$\pm\ r\ or\ l\ \frac{mn}{4}$
α (p q r)		$\pm\ r\ or\ l\ \left[\frac{mPn}{4}\right]$	$\pm r\ or\ l\left[\frac{mn}{4}\right]$

* $n < 2$

TABLES

FOR THE

DETERMINATION OF MINERALS

ARRANGED FOR THE STUDENTS OF THE

SCHOOL OF MINES

OF

COLUMBIA COLLEGE.

BY

THOMAS EGLESTON, JR.,

Professor of Mineralogy and Metallurgy.

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INTRODUCTION.

The following tables have been arranged for the use of the students of the School of Mines. They have been condensed from the lectures and are intended to familiarize the student with the principal characteristics of minerals, so that by the aid of two or three questions, relating to the operations they would be obliged to perform in the field, a mineral can be determined. They have been used with marked success in the practical study of mineralogy for several years.

T. EGLESTON, Jr.

School of Mines, 1871.

CLASSIFICATION OF THE SPECIES

ACCORDING TO

CRYSTALLINE FORM.

ISOMETRIC.

Diamond,
Garnet,
Lapis Lazuli,
Hauynite,
Leucite,
Analcite,
Halite,
Sal Ammoniac,
Fluorite,
Boracite,
Spinel,
Kalinite,
Iron,
Magnetite,
Franklinite,
Pyrite,
Pharmacosiderite,
Chromite,
Alabandite,
Linnæite,
Smaltite,
Cobaltite,
Ullmannite,
Sphalerite,
Lead,
Galenite,
Clausthalite,
Arsenolite,
Senarmontite,
Uraninite,
Copper,
Cuprite,
Bornite,
Tennantite,
Tetrahedrite,
Mercury,
Silver,
Amalgam,
Argentite,
Cerargyrite,
Bromyrite,
Embolite,
Gold,
Platinum.

TETRAGONAL.

Zircon,
Vesuvianite,
Wernerite,
Apophyllite,
Scheelite,
Braunite,
Hausmannite,
Cassiterite,
Stannite,
Rutile,
Octahedrite,
Stolzite,
Wulfenite,
Torbernite,
Chalcopyrite,
Calomel.

ORTHORHOMBIC.

Sulphur,
Chrysolite,
Iolite,
Muscovite,
Lepidolite,
Chondrodite,
Andalusite,
Topaz,
Staurolite,
Calamine,
Prehnite,
Natrolite,
Stilbite,
Talc,
Serpentine,
Nitre,
Aphthitalite,
Thenardite,
Mascagnite,
Barite,
Witherite,
Celestite,
Strontianite,
Anhydrite,
Aragonite,
Epsomite,
Diaspore,
Wavellite,
Chrysoberyl,
Goethite.
Marcasite,
Leucopyrite,

Arsenopyrite,
Scorodite,
Columbite,
Wolframite,
Pyrolusite,
Manganite,
Triplite,
Goslarite,
Brookite,
Bournonite,
Anglesite,
Cerussite,
Bismuthinite,
Aikenite,
Orpiment,
Valentinite,
Stibnite,
Autunite,
Molybdite,
Chalcosite,
Brochantite,
Atacamite,
Libethenite,
Olivenite,
Stephanite,
Polybasite.

MONOCLINIC.

Wollastonite,
Pyroxene,
Spodumene,
Petalite,
Amphibole,
Epidote,
Orthoclase,
Fibrolite,
Euclase,
Datolite,
Titanite,
Pectolite,
Laumontite,
Harmotome,
Heulandite,
Glauberite,
Mirabilite,
Borax,
Natron,
Barytocalcite,
Gypsum,
Pharmacolite,
Alunogen,
Melanterite,
Vivianite,
Bieberite,
Erythrite,
Annabergite,
Crocoite,
Realgar,
Kermesite,
Liroconite.
Malachite,
Azurite.

TRICLINIC.

Sassolite,
Rhodonite,
Anorthite,
Labradorite,
Oligoclase,
Albite,
Cyanite,
Cryolite,
Chalcanthite.

HEXAGONAL.

Water,
Tellurium,
Graphite,
Quartz,
Beryl,
Willemite,
Phenacite,
Biotite,
Nephelite,
Tourmaline,
Dioptase,
Chabazite,
Prochlorite,
Soda Nitre,
Apatite,
Calcite,
Dolomite,
Brucite,
Magnesite,
Corundum,
Alunite,
Hematite,
Pyrrhotite,
Copiapite,
Siderite,
Menaccanite,
Rhodochrosite,
Millerite,
Niccolite,
Zincite,
Smithsonite,
Pyromorphite,
Mimetite,
Bismuth,
Tetradymite,
Arsenic,
Antimony,
Molybdenite,
Cinnabar,
Proustite,
Pyrargyrite,
Iodyrite,
Iridosmine.

AMORPHOUS.

Carbonic Acid,
Opal,
Chrysocolla,
Chlorastrolite,
Sepiolite,
Aluminite,
Turquois,
Limonite,
Arseniosiderite,
Psilomelane,
Wad,
Remingtonite,
Zaratite,
Hydrozincite,
Minium.

CLASSIFICATION OF THE SPECIES

ACCORDING TO

HARDNESS.

H. < 1

Carbonic Acid,
Mercury,
Molybdite,
Sassolite,
Water.

H.=0·5—6

Wad.

H.=1—1·5

Cerargyrite,
Embolite,
Iodyrite,
Kermesite,
Molybdenite,
Natron,
Talc.

H.=1—2

Aluminite,
Arseniosiderite,
Bromyrite,
Calomel,
Graphite.

H.=1—2·5

Sulphur.

H.=1·5

Arsenolite,
Brucite,
Copiapite,
Ice,
Lead.

H.=1·5=2

Alunogen,
Gypsum,
Mirabilite,
Orpiment,
Realgar,
Sal-Ammoniac,
Soda-Nitre,
Tetradymite,
Vivianite.

H.=1·5—2·5

Erythrite.

H.=2

Melanterite,
Nitre,
Stibnite.

H.=2—2·25

Epsomite.

H.=2—2·5

Aikinite,
Argentite,
Autunite,
Bismuth,
Bismuthinite,
Borax,
Cinnabar,
Goslarite,
Hydrozincite,
Liroconite,
Mascagnite,
Pharmacolite,
Prochlorite,
Proustite,
Pyrargyrite,
Pyrolusite,
Senarmontite,
Stephanite,
Tellurium,
Thenardite,
Torbernite.

H.=2—3

Chrysocolla,
Kalinite,
Lepidolite,
Minium,
Polybasite.

H.=2·5

Chalcanthite.
Cryolite,
Halite,
Muscovite,
Pharmacosiderite,
Sepiolite.

H.=2·5—2·7

Galenite.

H.=2·5—3

Annabergite,
Bournonite,
Chalcocite,
Clausthalite,
Copper,
Crocoite,
Glauberite,
Gold,
Silver,
Valentinite.

H.=2·5—3·5

Barite,
Calcite.

H.=2·7—2·9

Biotite.

H.=2·7—3

Anglesite,
Wulfenite.

H.=2·75—3

Stolzite.

H.=3

Bornite,
Olivenite,
Serpentine.

H.=3—3·2

Zaratite.

H.=3—3·5

Amalgam,
Anhydrite,
Antimony,
Aphthitalite,
Atacamite,
Celestite,
Cerussite,
Millerite.

H.=3—4·5

Tetrahedrite.

H.=3·2—4

Wavellite.

H.=3·5

Arsenic,
Laumontite,
Mimetite.

H.=3·5—3·7

Witherite.

H.=3·5—4

Alabandite,
Alunite,
Aragonite,
Brochantite,
Chalcopyrite,
Cuprite,
Dolomite,
Heulandite,
Malachite,
Pyromorphite,
Scorodite,
Sphalerite,
Stilbite,
Strontianite,
Tennantite.

H.=3·5=4·2

Azurite.

H.=3·5—4·5

Magnesite,
Pyrrhotite,
Rhodochrosite,
Siderite.

H.=4

Barytocalcite,
Fluorite,
Libethenite,
Manganite,
Stannite.

H.=4—4·5

Chabazite,
Platinum,
Zincite.

H.=4—5

Pectolite.

H.=4·5

Iron,
Harmotome.

H.=4·5—5

Apatite,
Apophyllite,
Scheelite,
Wollastonite.

H.=5

Calamine,
Chromite,
Dioptase,
Franklinite,
Smithsonite.

H.=5—5·5

Goethite,
Hausmannite,
Leucopyrite,
Limonite,
Natrolite,
Niccolite,
Titanite,
Triplite,
Ullmannite,
Wolframite.

H.=5—6

Amphibole,
Cyanite,
Menaccanite,
Psilomelane,
Pyroxene,
Wernerite.

H.=5—6·5

Hematite.

H.=5·5

Analcite,
Chromite,
Cobaltite,
Datolite,
Lapis Lazuli,
Linnæite,
Uraninite,
Willemite.

H.=5·5—6

Arsenopyrite,
Brookite,
Chlorastrolite,
Haüynite,
Leucite,
Magnetite,
Nephelite,
Octahedrite,
Smaltite.

H.=5·5—6·5

Opal,
Rhodonite.

H.=6

Anorthite,
Columbite,
Labradorite,
Oligoclase,
Orthoclase,
Turquois.

H.=6—6·5

Albite,
Braunite,
Chondrodite,
Marcasite,
Petalite,
Pyrite,
Rutile.

H.=6—7

Cassiterite,
Fibrolite,
Iridosmine,
Prehnite.

H.=6·5

Epidote,
Vesuvianite.

H.=6·5—7

Chrysolite,
Diaspore,
Garnet,
Spodumene.

H.=7

Boracite,
Quartz.

H.=7—7·5

Iolite,
Staurolite,
Tourmaline.

H.=7·5

Andalusite,
Euclase,
Zircon.

H.=7·5—8

Beryl,
Phenacite.

H.=8

Spinel,
Topaz.

H.=8·5

Chrysoberyl.

H.=9

Corundum.

H.=10

Diamond.

H. undetermined.

Bieberite,
Remingtonite.

CLASSIFICATION OF THE SPECIES

ACCORDING TO

SPECIFIC GRAVITY.

G.=0·918—1
Water.
G.=1·2—1·6
Sepiolite.
G.=1·4
Mirabilite,
Natron.
G.=1·48
Sassolite.
G.=1·5
Carbonic Acid,
Sal-Ammoniac.
G.=1·5—1·8
Kalinite.
G.=1·6
Aluminite.
G.=1·6—1·8
Alunogen.
G.=1·7
Aphthitalite,
Borax,
Epsomite,
Mascagnite.
G.=1·8
Melanterite.
G.=1·9
Nitre.
G.=1·9—2·1
Goslarite.
G.=1·9—2·3
Opal.
G.=2
Graphite.
G.=2—2·1
Chabazite.
G.=2—2·2
Chrysocolla,
Soda-Nitre,
Stilbite.
G.=2—2·5
Biotite.
G.=2·072
Sulphur.
G.=2·1—2·2
Heulandite,
Natrolite.
G.=2·1—2·5
Halite.
G.=2·2
Analcite,
Chalcanthite.
G.=2·28—2·41
Laumontite.
G.=2·3
Brucite,
Gypsum,
Wavellite.
G.=2·3—2·4
Lapis Lazuli.
G.=2·35—2·39
Apophyllite.
G.=2·4
Harmotome.
G.=2·4—2·5
Leucite.
G.=2·4—2·8
Haüynite.
G.=2·42—2·45
Petalite.
G.=2.47—2·6
Serpentine.
G.=2·5—2·6
Iolite,
Nephelite,
Zaratite.
G.=2·5—2·7
Alunite,
Calcite,
Quartz.
G.=2·53—2·59
Orthoclase.
G.=2·54—2·64
Albite.
G.=2·6
Vivianite.
G.=2·6—2·7
Anorthite,
Beryl,
Labradorite,
Oligoclase,
Pharmacolite,
Wernerite.
G.=2·6—2·8
Glauberite,
Prochlorite,
Talc,
Turquois.
G.=2·6—3
Phenacite.
G.=2·7
Thenardite.
G.=2·7—2·8
Pectolite.
G.=2·7—2·9
Wollastonite.
G.=2·8—2·9
Anhydrite,
Dolomite,
Liroconite,
Prehnite.
G.=2·8—3
Datolite,
Lepidolite,
Magnesite.
G.=2·8—3·1
Muscovite.
G.=2·9
Aragonite,
Boracite,
Erythrite.

G.=2·9—3
Cryolite,
Pharmacosiderite.

G.=2·9—3·4
Amphibole.

G.=3—3·1
Annabergite,
Autunite,
Euclase.

G.=3—3·2
Tourmaline.

G.=3·1
Chondrodite,
Fluorite.

G.=3·1—3.2
Andalusite,
Spodumene.

G.=3·1—3·3
Scorodite.

G.=3·15—4
Garnet.

G.=3·18
Chlorastrolite.

G.=3·2
Fibrolite.

G.=3·2—3·3
Dioptase.

G.=3·2—3·5
Pyroxene.

G.=3·25
Apatite.

G.=3·3—3.4
Chrysolite,
Vesuvianite.

G.=3·3—3·5
Diaspore.

G.=3·3—3·7
Titanite.

G.=3·3—4
Epidote.

G.=3·35—3·5
Calamine.

G.=3·4
Orpiment.

G.=3·4—3·6
Realgar,
Rhodonite,
Rhodochrosite.

G.=3·4—3·8
Staurolite,
Triplite.

G.=3·5
Arseniosiderite,
Topaz.

G.=3·5—3·6
Cyanite,
Hydrozincite,
Torbernite.

G.=3·5—3·8
Azurite,
Chrysoberyl.

G.=3·5—4·9
Spinel.

G.=3·55
Diamond.

G.=3·6
Arsenolite,
Barytocalcite.

G.=3·6—3·7
Strontianite.

G.=3·6—3·8
Libethenite.

G.=3·6—4
Limonite.

G.=3·7—3·9
Siderite.

G.=3·7—4
Malachite.

G.=3·7—4·3
Psilomelane.

G.=3·8—3·9
Brochantite,
Octahedrite.

G.=3·8—4·1
Willemite.

G.=3·9
Celestite.

G.=3·9—4
Alabandite,
Corundum,
Sphalerite.

G.=4—4·3
Atacamite.

G.=4—4·4
Goethite,
Smithsonite.

G.=4—4·5
Bornite.

G.=4—4·7
Zircon.

G.=4—4·8
Barite.

G.=4·1
Brookite.

G.=4·1—4·2
Rutile.

G.=4·1—4·3
Chalcopyrite.

G.=4·1—4·4
Olivenite.

G.=4·2—4·3
Witherite.

G.=4·2—4·4
Manganite.

G.=4·3—4·4
Tennantite.

G.=4·3—4·5
Chromite,
Stannite.

G.=4·4—4·7
Pyrrhotite.

G.=4·4—4·8
Molybdenite.

G.=4·4—5
Bornite.

G.=4·5—4·6
Kermesite,
Stibnite.

G.=4·5—5
Menaccanite.

G.=4·5—5·1
Tetrahedrite.

G.=4·5—5·3
Hematite.

G.=4·6
Minium.

G.=4·6—4·8
Marcasite.

G.=4·7
Hausmannite.

G.=4·7—4·8
Braunite.

G.=4·8—4·9
Pyrolusite.

G.=4·8—5
Linnæite,
Pyrite.

G.=4·9—5·1
Magnetite.

G.=5·2—5·3
Senarmontite.

G.=5·2—5·6
Millerite.

G.=5·3—5·8
Embolite.
G.=5·4—5·5
Proustite.
G.=5·4—5·8
Zincite.
G.=5·4—6·4
Columbite.
G.=5·5
Cerargyrite,
Iodyrite,
Valentinite.
G.=5·5—5·8
Chalcocite.
G.=5·5—6·5
Franklinite.
G.=5·7—5·9
Bournonite,
Pyrargyrite.
G.=5·8—6
Bromyrite,
Cuprite.
G.=5·9
Arsenic.
G.=5·9—6·1
Crocoite.

G.=6
Scheelite.
G.=6—6·3
Cobaltite.
G.=6—6·4
Arsenopyrite.
G.=6·1—6·3
Tellurium.
G.=6·1—6·8
Aikinite.
G.=6·2
Anglesite,
Polyasite,
Stephanite.
G.=6·2—6·5
Ullmannite.
G.=6·3—6·9
Wulfenite.
G.=6·3—7·1
Cassiterite.
G.=6·4
Calomel,
Cerussite,
Uraninite.
G.=6·4—6·5
Bismuthinite.

G.=6·4—7
Smaltite.
G.=6·5—7
Pyromorphite.
G.=6·6—6·7
Antimony.
G.=7—8·7
Leucopyrite.
G.=7—8·8
Clausthalite.
G.=7·1—7·2
Mimetite.
G.=7·1—7·3
Argentite.
G.=7·1—7·5
Wolframite.
G·=7·2—7·7
Galenite.
G.=7·2—8·4
Tetradymite.
G.=7·3—7·6
Niccolite.
G.=7·3—7·8
Iron.
G.=7·8—8·1
Stolzite.

G.=8·9
Cinnabar,
Copper.
G.=9·7
Bismuth.
G·=10—14
Amalgam.
G.=1·01—11·1
Silver.
G.=11·4
Lead.
G.=13·5
Mercury.
G.=15—19
Gold.
G.=16—19
Platinum.
G.=19—21
Iridosmine.

Undetermined.

Bieberite,
Copiapite,
Molybdite,
Remingtonite,
Wad.

CLASSIFICATION OF THE SPECIES.

SYSTEMATIC ARRANGEMENT.

Hydrogen.
Water. page 1

Sulphur.
Sulphur.

Tellurium.
Tellurium.

Carbon.
Diamond,
Graphite,
Carbonic Acid.

Boron.
Sassolite.

Silicon.
Oxygen Compounds.
Quartz,
Opal.

SILICATES.

ANHYDROUS SILICATES.

I. Bisilicates.
Amphibole Group.
Wollastonite, p. 2
Pyroxene,
Rhodonite,
Spodumene,
Petalite,
Amphibole.

Beryl Group.
Beryl.

II. Unisilicates.
Chrysolite Group.
Chrysolite.

Phenacite Group.
Willemite,
Phenacite, p. 3

Garnet Group.
Garnet.

Vesuvianite Group.
Zircon,
Vesuvianite.

Epidote Group.
Epidote.

Iolite Group.
Iolite.

Mica Group.
Biotite,
Muscovite,
Lepidolite.

Scapolite Group.
Wernerite, p. 4

Nephelite Group.
Nephelite.

Leucite Group.
Lapis Lazuli,
Hauynite,
Leucite.

Feldspar Group.
Anorthite,
Labradorite,
Oligoclase,
Albite,
Orthoclase, p. 5

III. Subsilicates.
Chondrodite,
Tourmaline,
Andalusite,
Fibrolite,
Cyanite,
Topaz,
Euclase,
Datolite,
Titanite, p. 6
Staurolite.

HYDROUS SILICATES.

I. Bisilicates.
Pectolite Group.
Pectolite,
Laumontite.

Dioptase Group.
Dioptase,
Chrysocolla.

II. Unisilicates.
Calamine Group.
Calamine,
Prehnite,
Chlorastrolite.

Apophyllite Group.
Apophyllite. p. 7

ZEOLITE SECTION.

I. Unisilicates.
Natrolite.

II. Bisilicates.
Analcite,
Chabazite,
Harmotome,
Stilbite,
Heulandite.

MARGAROPHYLLITE SECTION.

I. Bisilicates.
Talc Group.
Talc.

Sepiolite Group.
Sepiolite.

II. Unisilicates.
Serpentine Group.
Serpentine. p. 8

III. Subsilicates.
Chlorite Group.
Prochlorite.

Potassium.
Nitre,
Aphthitalite.

Sodium.
Soda Nitre,
Thenardite,
Glauberite,
Mirabilite,
Halite,
Borax, p. 9
Natron.

Ammonium.
Mascagnite,
Sal Ammoniac.

Barium.
Barite,
Witherite,
Barytocalcite.

Strontium.
Celestite,
Strontianite.

Calcium.
Anhydrite, p. 10
Gypsum,
Fluorite,
Apatite,
Pharmacolite,
Aragonite,
Calcite,
Dolomite,
Scheelite.

Magnesium.
Brucite, p. 11
Epsomite,
Boracite,
Magnesite,
Spinel.

Aluminium.
Corundum,
Diaspore,
Aluminite,
Alunogen,
Alunite, p. 12
Kalinite,
Cryolite,
Turquois,
Wavellite,
Chrysoberyl.

Iron.
Iron,
Magnetite,
Franklinite,
Hematite, p. 13
Goethite,
Limonite,
Pyrrhotite,
Pyrite,
Marcasite,
Melanterite,
Copiapite,
Vivianite,
Leucopyrite, p. 14
Arsenopyrite,
Scorodite,
Pharmacosiderite,
Arseniosiderite,
Siderite,
Menaccanite,
Chromite,
Columbite,
Wolframite. p. 15

Manganese.
Braunite,
Hausmannite,
Pyrolusite,
Manganite,
Psilomelane,
Wad,
Alabandite,
Triplite,
Rhodochrosite, p. 16

Cobalt.
Linnæite,
Bieberite,
Smaltite,
Cobaltite,
Erythrite,
Remingtonite,

Nickel.
Millerite,
Niccolite,
Ullmannite, p. 17
Annabergite,
Zaratite.

Zinc.
Zincite,
Sphalerite,
Goslarite,
Smithsonite,
Hydrozincite.

Tin.
Cassiterite,
Stannite. p. 18

Titanium.
Rutile,
Octahedrite,
Brookite.

Lead.
Lead,
Minium,
Galenite,
Bournonite,
Anglesite,
Clausthalite,
Pyromorphite, p. 19
Mimetite,
Cerussite,
Crocoite,
Stolzite,
Wulfenite.

Bismuth.
Bismuth,
Bismuthinite,
Aikinite,
Tetradymite, p. 20

Arsenic.
Arsenic,
Arsenolite,
Realgar,
Orpiment.

Antimony.
Antimony,
Senarmontite,
Valentinite,
Stibnite,
Kermesite. p. 21

Uranium.
Uraninite,
Autunite,
Torbernite.

Molybdenum.
Molybdite,
Molybdenite.

Copper.
Copper,
Cuprite,
Chalcocite,
Bornite, p. 22
Chalcopyrite,
Tennantite,
Tetrahedrite,
Chalcanthite,
Brochantite,
Atacamite,
Libethenite,
Olivenite,
Liroconite, p. 23
Malachite,
Azurite.

Mercury.
Mercury,
Cinnabar,
Calomel.

Silver.
Silver,
Amalgam,
Argentite,
Proustite,
Stephanite, p. 24
Pyrargyrite,
Polybasite,
Cerargyrite,
Bromyrite,
Embolite,
Iodyrite.

Gold.
Gold.

Platinum.
Platinum.

Iridium.
Iridosmine.

SYSTEMS OF CRYSTALLIZATION.

NO.	SIMPLE FORMS.	AXES.
1	Octahedron, or cube.	3 axes rectangular and equal.
2	Tetragonal pyramid, or right prism with a square base.	3 axes rectangular, 2 equal.
3	Rhombic pyramid, or right prism with a rhombic base.	3 axes rectangular, and unequal.
4	Monoclinic pyramid, or inclined rhombic prism.	3 axes unequal, 2 rectangular.
5	Triclinic pyramid, or doubly inclined rhomboidal prism.	3 axes unequal, and unequally inclined.
6	Hexagonal pyramid, hexagonal prism, or rhombohedron.	4 axes, 3 equal and equally inclined, 1 at right angles to the other three.

NAMES USED BY DIFFERENT AUTHORS.

NO.	MOHS.	WEISS & ROSE.	PHILLIPS.	NAUMANN.	DELAFOSSE.	DANA. 1854.	DANA. 1869.
1	Tessular.	Regular.	Cubic.	Tesseral.	Cubic.	Monometric.	Isometric.
2	Pyramidal.	2 and 1 axial.	Pyramidal.	Tetragonal.	Tetragonal.	Dimetric.	Tetragonal.
3	Orthotype.	1 and 1 axial.	Prismatic.	Rhombic.	Orthorhombic.	Trimetric.	Orthorhombic.
4	Hemiorthotype.	2 & 1 membered.	Oblique.	Monoclinohedric.	Clinorhombic.	Monoclinic.	Monoclinic.
5	Anorthotype.	1 & 1 membered.	Anorthic.	Triclinohedric.	Clinohedric.	Triclinic.	Triclinic.
6	Rhombohedral.	3 and 1 axial.	Rhombohedral.	Hexagonal.	Hexagonal.	Hexagonal.	Hexagonal.

SCALE OF HARDNESS.

1.—Talc. Laminated light green variety. Easily scratched by the nail.

2.—Gypsum. Crystallized variety. Not easily scratched by the nail. Does not scratch a copper coin.

3.—Calcite. Transparent variety. Scratches and is scratched by a copper coin.

4.—Fluor. Crystalline variety. Not scratched by a copper coin. Does not scratch glass.

5.—Apatite. Transparent variety. Scratches glass with difficulty. Easily scratched by the knife.

5.5.–Scapolite. Crystalline variety.

6.—Orthoclase. White cleavable variety. Scratches glass easily. Not easily scratched by the knife.

7.—Quartz. Transparent variety. Not scratched by the knife. Yields with difficulty to the file.

8.—Topaz. Transparent variety. Harder than flint.

9.—Sapphire. Cleavable varieties. Harder than flint.

10.—Diamond. Harder than flint.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters
Water,	Hexagonal Prism.	Parallel to the base.	Conchoidal.	1	1.5	Vitreous.	White.	Colorless, greenish and bluish in large masses.		Becomes liquid at 0°, boils at 100°.
Sulphur,	Rt. Rhombic Prism of 101° 47′	Imperfect Parallel to the Prism and Octahedron.	Conchoidal.	2.072	1 to 2.5	Resinous. Vitreous and adamantine.	Sulphur yellow. Sometimes reddish or greenish.	Yellow when transparent. Double refracting.	Not acted on.	When pure volatilizes without residue, giving off sulphurous acid.
Tellurium,	Hexagonal Prism.	Parallel to the Prism.	Lamellar.	6.1 to 6.3	2 to 2.5	Metallic.	Tin white.	Tin white.		On charcoal burns with green flame; volatilizes leaving a white ring with a red border.
Diamond,	Octahedron.	Parallel to the faces of the Octahedron.	Conchoidal.	3.55	10	Brilliant adamantine.		Colorless, smoky, yellow, green, blue & black.	Not acted on.	Burns without residue before the oxyhydrogen blowpipe.
Graphite,	Hexagonal Prism.	Parallel to the base of the Prism.	Lamellar.	2	1 to 2	Metallic.	Black and lustrous.	Steel gray.	Not acted on.	Infusible. Slowly burns away in oxidizing flame
Carbonic Acid.				1.5	–1			Colorless.		
Sassolite,	Doubly inclined Prism of 118° 30′	Parallel to the base.	Lamellar.	1.48	–1	Pearly.	White.	White.	Soluble in water.	Fuses in the flame of a candle. [illegible]
Quartz,	Rhombohedron of 94° 15′	Difficult parallel to the faces of the Rhombohedron.	Conchoidal.	2.5 to 2.7	7	Vitreous and resinous.	White if pure. If impure, often of the same color as the impurity.	Colorless, white, black, red, green, double refracting.	Not acted on.	Infusible, ~~Soluble in~~ with Carbonate of Soda. effervesces to a clear bead
Opal,			Conchoidal.	1.9 to 2.3	5.5 to 6.5	Vitreous and resinous.	White.	White, yellow, red, brown, green, gray.	More or less completely soluble. in alkalies	Infusible. Gives off water and becomes opaque.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Wollastonite,	Inclined Rhombic Prism of 95°35′	Parallel to the base.	Uneven.	2.7 to 2.9	4.5 to 5	Vitreous and pearly.	White orsame as color.	White, gray. yellow, red, brown.	Gelatinizes.	Phosphorescent when heated on chcl. Fuses to a colorless bead. Borax, transp. glass & skeleton of Silica. Swells with Soda in excess and is infusible.
Pyroxene,	Inclined Rhombic Prism of 87°5′	Parallel to the Prism & base.	Conchoidal or uneven.	3.2 to 3.5	5 to 6	Vitreous, resinous, pearly	Whiteor gray, or paler than color.	White throughgreen to black.	Some varieties are slightly acted on.	Fusible to a glass darker than the specimen.
Rhodonite,	Doubly Inclined Rhomboidal Prism of 73°48′	More or less difficultParallel to thefaces of the Prism.	Uneven.	3.4 to 3.6	5.5 to 6.5	Vitreous and pearly.	Reddish white.	Red, rose, brown.	More or less completely dissolved. [illegible]	Fusible. [illegible] in O.F
Spodumene	Inclined Rhombic Prism of 87°	Parallelto the Ortho Pinacoid.	Uneven.	3.1 to 3.2	6.5 to 7	Pearly and vitreous	White.	White, gray, green,reddish	Not acted on.	Loses color,intumesces, fuses to a glass. Reaction for Lithia.
Petalite,	Inclined Rhombic Prism of 86°20′	Perfect parallel to the base Easy parallel to clino dome.	Imperfectly conchoidal and scaly.	2.42 to 2.45	6 to 6.5	Vitreous.	White.	Milk white, white tinted gray, red or green.	Not acted on.	Melts on the edges and colors the flame red, from Lithia, sometimes the reaction for Fl.
Amphibole,	Inclined Rhombic Prism of 124°11′	Parallel to the Prism.	Conchoidal or uneven.	2.9 to 3.4	5 to 6	Vitreous. pearly, silky.	White orpaler than color.	White throughgreen to black	Some varieties are slightly acted on.	~~Fuses to a glass darker than the specimen.~~ like Pyroxene
Beryl,	Hexagonal Prism.	Easy Parallel to the base. Difficult Parallel to Prism.	Conchoidal or uneven.	2.6 to 2.7	7.5 to 8	Vitreous.	White.	Green, blue, yellow, red, white.	Not acted on.	Fusible with difficulty on the edges. to a vesicular glass
Chrysolite,	RightRhomb. Prism of 119° 13′	Easy Parallel to the macro-Pinacoid. Traces Parallel to Br'chy Pinac.	Conchoidal.	3.3 to 3.4	6.5 to 7	Vitreous.	White.	Green, yellow brown. Double Refracting.	Gelatinizes.	Infusible.
Willemite,	Rhombohedron 116°1′	Parallel to Hexagonal Prism and Pinacoid.	Conchoidal and Imperfect.	3.8 to 4.1	5.5	Vitreous and resinous.	White.	Colorl's,white yellow, brown orgrayish blk. Dble. refract'g	Gelatinizes.	Becomes opaque & fuses with difficulty on the edges.

$(Li_2O, Na_2O)SiO_2 + Al\,SiO_3$

$\ddot{R}\,\dddot{Si}$

$(BeO + \frac{1}{2}Al_2O_3)SiO_2$

$(MgO, FeO)_2\,SiO_2$

Zn_2O, SiO_2

with NaO CO₂ and NaO, 2BO₃ in O.F Zn bead.

	Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
$BeA_2\ \dot{S}iO_2$	Phenacite,	Rhombohedron, 116° 36′	Indistinct.	Conchoidal and uneven.	2.6 to 3	7.5 to 8	Vitreous.	Colorless.	Colorless yellow, brown Double refracting.	Insoluble.	Infusible.
$R_2O, \dot{S}iO_2 + R_2O_3, \dot{S}iO_2$	Garnet,	Rhombic Dodecahedron.	Dodecahedral Generally indistinct.	Subconchoidal, uneven.	3.15 to 4	6.5 to 7	Vitreous or resinous.	Colorless.	Red, brown, yellow, white, green, black.	Imperfectly soluble. after calcination.	Fusible. most varieties fuse readily.
$Zr_2\ \dot{S}iO_2$	Zircon,	Right Square Prism.	Parallel to Prism and Octahedron.	Conchoidal, uneven.	4 to 4.7	7.5	Vitreous.	Colorless.	Colorless, red, brown, yellow pink, green. Double refracting.	Insoluble.	Infusible. not attacked [illegible]
$(CaO, MgO, FeO)^3 + 2/5\ (Al_2O_3, Fe_2O_3)\dot{S}iO_2$	Vesuvianite	Right Square Prism.	Parallel to both Prisms.	Imperfectly conchoidal.	3.3 to 3.4	6.5	Vitreous or resinous.	White.	Green, brown, yellow, red, blue. Dichroic.	Partially soluble in HCl. Gelatinizes after calcination.	Intumesces and fuses. Easily
$CaO(Fe_2O_3, Al_2O_3)\dot{S}iO_2$	Epidote,	Inclined Rhombic Prism of 69° 56′	Easy Parallel to the base.	Uneven.	3.3 to 4	6.5	Vitreous and pearly on the easy fracture.	Colorless, grayish or reddish.	Green, yellow, brown, black.	Gelatinizes. same as vesuvianite	Infusible. dark bead. Some only on edges.
$MgO, FeO, \dot{S}iO_2, Al_2O_3, \dot{S}iO_2$	Iolite,	Right Rhombic Prism of 119° 10′	Easy Paral. to Macro, & diff. paral. to Brachy Pinacoid.	Conchoidal.	2.5 to 2.6	7 to 7.5	Vitreous	Colorless.	Blue, green, yellow, gray, and brown. Pleochroic.	Partially acted on.	Fusible with difficulty.
$\dot{K}, \dot{M}g, \dot{F}eO + \ddot{A}l, \ddot{F}e.\ \dot{S}iO_2$	Biotite,	Hexagonal.	Parallel to the base.	Lamellar.	2 to 2.5	2.7 to 2.9	Vitreous.	White or gray	White, gray, brown, red, green, black.	Decomposed by $\dddot{S}$.	Fusible with difficulty. [illegible]
$\dot{K}, \ddot{A}l, \ddot{F}e, \dot{S}iO_2 + \dot{S}iO_2$	Muscovite,	Right Rhombic Prism near 120°	Parallel to the base.	Lamellar.	2.8 to 3.1	2.5	Vitreous.	White or gray	White, gray, brown, green, black.	Insoluble.	Fusible with difficulty.
$\dot{K}, \dot{L}i, \ddot{A}l, \ddot{F}e$ [illegible] $\dot{S}i$	Lepidolite,	Right Rhombic Prism of 120° 30′	Parallel to the base.	Lamellar.	2.8 to 3	2 to 3	Pearly or vitreous.	White.	White, green, red, gray, violet.	Partially Attacked by acids.	Fusible. Reaction for Li.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
[illegible] SiO_2 Wernerite,	Right Square Prism.	Parallel to both Prisms.	Uneven.	2.6 to 2.7	5 to 6	Vitreous or pearly on the fracture.	Colorless.	White, gray, yellow, green, blue and red.	Partially soluble in H Cl.	Fuses ~~with difficulty~~. easily with intumescence
Nephelite,	Hexagonal Prism.	Imperfect Parallel to the base and prism.	Conchoidal and unequal.	2.5 to 2.6	5.5 to 6	Vitreous or resinous	Colorless.	Gray, white.	Gelatinizes.	Melts with difficulty.
[illegible] Ca [illegible] $Al_2O_3, Fe_2O_3, S, SiO_2$ Lapis Lazuli,	Rhombic Dodecahedron.	Parallel to the Rhombic Dodecahedron.	Uneven.	2.3 to 2.4	5.5	Vitreous or dull.	Clear blue.	Blue.	Gelatinizes. with HCl evolves H[illegible]	Melts to a white glass. easily with intumescence.
[illegible]aO, $Al_2O_3, 3SiO_2 + CaSiO_2$ Hauynite,	Rhombic Dodecahedron.	Parallel to the Rhombic Dodecahedron.	Conchoidal, unequal.	2.4 to 2.8	5.5 to 6	Vitreous.	Bluish white.	Blue.	Gelatinizes.	~~Decrepitates and fuses with difficulty.~~ [illegible] on edges to a white glass,
[illegible]$SiO_2 + Al_2O_3, SiO_2$ Leucite,	Tetragonal Tris-Octahedron.	Parallel to the Rhombic Dodecahedron.	Conchoidal and unequal.	2.4 to 2.5	5.5 to 6	Vitreous or resinous.	Colorless.	White, gray, red.	Completely soluble, but does not gelatinize.	Infusible.
Anorthite,	Doubly Inclined Rhomboidal Prism of 120° 30′	Parallel to the base.	Conchoidal.	2.6 to 2.7	6	Vitreous or pearly.	Colorless.	Colorless, white.	Soluble and deposits pulverulent silica.	Fusible. on the edges
Labradorite	Doubly inclined Rhomboidal Prism 121° 37′	Parallel to the base.	Imperfectly conchoidal, uneven, scaly.	2.6 to 2.7	6	Vitreous on the faces, pearly on the fracture.	Colorless.	Gray, yellow, red, blue, with play of colors.	Imperfectly ~~Completely~~ soluble, ~~but with difficulty~~.	Fusible. with difficulty to a clear bead.
Oligoclase,	Doubly inclined Rhomboidal Prism of 120° 42′	Parallel to the base.	Conchoidal, uneven, scaly.	2.6 to 2.7	6	Vitreous or pearly on the cleavage, pearly on the fracture.	Colorless.	White, green, red.	Insoluble.	Melts with difficulty. Colors the flame yellow.
Albite,	Doubly inclined Rhomboidal Prism of 120° 47′	Easy parallel to the base. Less easy parallel to prism	Imperfectly conchoidal, uneven.	2.54 to 2.64	6 to 6.5	Vitreous, pearly on base & sometimes on the prism.	Colorless.	Colorless, pale red, yellow, green, gray.	Insoluble.	Melts ~~with difficulty~~ easily on the edges. Colors the flame yellow.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Orthoclase,	Inclined Rhombic Prism of 118° 48′	Ea. paral. to base. Less ea. & very often interrupted paral. to prism	Conchoidal or unequal.	2.53 to 2.59	6	Vitreous, pearly on the base.	Colorless.	Colorless, white, rose, red, brown, yellow, green.	Not acted on.	Melts with difficulty on the edges. colors flame violet.
Chondrodite,	Right Rhomb. Prism of 49° 59′	Indistinct.	Conchoidal.	3.1	6 to 6.5	Resinous.	White, yellowish or greenish.	Yellow, brown, red, green, gray.	Gelatinizes.	Infusible. ~~With Borax, if saturated, becomes cloudy on flaming.~~ Reaction for Fl.
Tourmaline	Rhombohedron of 139° 8′	Imperfect parallel to the Rhomb and Prism.	Conchoidal, and uneven.	3.0 to 3.2	7 to 7.5	Vitreous.	Colorless.	Colorless, gray, red, blue, brown, yellow black. Dichroic.	Not acted on.	Swells and gives the reaction for Bö. with [illegible] + Ca Fl.
Andalusite,	Right Rhombic Prism of 90° 44′	Perf. paral. to the prism. Imperf. paral. to the Macro and Brachy Pinac.	Conchoidal, scaly, or uneven.	3.1 to 3.2	7.5	Vitreous	White.	Green, red, gray, brown. From Brazil, shows Polychroism.	Not acted on.	Infusible.
Fibrolite,	Inclined Rhombic Prism of 97°	Parallel to the ~~Brachy~~ Orth. Pinacoid.	Uneven.	3.2	6 to 7	Vitreous.	Colorless.	Gray or brown. Dichroous.	Not acted on.	Infusible.
Cyanite,	Doubly inclined Rhomboidal Prism of 106° 15′	Three Cleavages, one of which is easy the others less so.	Uneven.	3.5 to 3.6	5 to 6	Pearly and vitreous.	Colorless.	Colorless, white, blue, green, gray, black.	Not acted on. by HO, partially by SO_3.	Infusible.
Topaz,	Right Rhombic Prism of 124° 17′	Perf. paral. to base. Imperf. paral. to the Macro & Brachy-domes.	Conchoidal or uneven.	3.5	8	Vitreous.	Colorless.	Colorless, yellow, red, greenish blue. Pyroelectric.	Not acted on. [illegible]	Infusible, ~~but cracks~~ at a high heat. [illegible]
Euclase,	Inclined Rhombic Prism of 140° 40′	Very easy parallel to the Prism.	Conchoidal.	3.0 to 3.1	7.5	Vitreous or pearly.	Colorless.	Colorless, green, blue. Electric by friction.	Not acted on.	with [illegible] Swells and melts to a white enamel.
Datolite,	Inclined Rhombic Prism of 76° 38′	Easy Parallel to the Ortho-Pinacoid.	Uneven or conchoidal.	2.8 to 3	5.5	Vitreous.	White.	Colorless, white, green, gray, violet, red or yellow.	Gelatinizes.	Swells and melts easily to a clear glass. Gives the reaction for Boracic Acid.

[illegible]

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Titanite,	Inclined Rhombic Prism of 113° 31′	Easy parallel to the Prism.	Imperfectly conchoidal, uneven.	3.3 to 3.7	5 to 5.5	Adamantine or vitreous.	White or red.	White, yellow red, brown, green, gray, Pleichroism. Pyroelectric.	In fine powder HCl imperfectly. $\ddot{S}$ completely.	Melts with intumescence to a dark glass.
Staurolite,	Right Rhombic Prism of 129° 26′	Perf. parallel to the Macro-Pinacoid. Imperf. parallel to the Prism.	Conchoidal or uneven.	3.4 to 3.8	7 to 7.5	Vitreous or resinous.	White.	Dark red, reddish brown, black.	Partly acted on by $\ddot{S}$.	Infusible.
Pectolite,	Inclined Rhombic Prism.	Easy parallel to the Prism. Pectolite	Fibrous.	2.7 to 2.8	4 to 5	Pearly and silky on the fracture.	White.	White, gray, brown.	~~After heating~~, soluble in HCl. giving up gelatinous silica.	Melts easily to a white enamel.
Laumontite	Inclined Rhombic Prism of 86° 16′	Easy parallel to the Prism.	Uneven.	2.28 to 2.41	3.5	Vitreous or pearly on the cleavage.	White.	White, yellow gray, red. Exfoliates in the air, losing water.	Gelatinizes with HCl.	Intumesces and melts to a white glass.
Dioptase,	Rhombohedron of 95° 55′	Parallel to the Rhombohedron.	Conchoidal or uneven.	3.2 to 3.3	5	Vitreous or resinous.	Emerald green.	Emerald green.	Gelatinizes.	Infusible Black in the oxidizing flame, and red in the reducing flame.
Chrysocolla,	Amorphous.		Conchoidal.	2 to 2.2	2 to 3	Resinous.	Greenish white.	Green, blue, brown, black.	Soluble, leaving non gelatinous silica.	Colors the flame green, but is infusible.
Calamine,	Rt. Rhombic Prism of 104° 13′	Easy parallel to the Prism. Less easy parallel to base.	Conchoidal or uneven.	3.35 to 3.50	5	Vitreous, adamantine, pearly.	White.	Colorless, white, gray, yellow, brown green, blue, Pyroelectric.	Gelatinizes.	~~Swells, gives a slight flame with a green luster~~, melts with difficulty on the edges.
Prehnite,	Rt. Rhombic Prism of 99° 56′	Easy parallel to base, more difficult parallel to the Prism.	Uneven.	2.8 to 2.9	6 to 7	Vitreous or pearly.	Colorless.	White, gray, green. Pyroelectric.	soluble ~~Gelatinizes~~ without [illegible] tion. calcination	Swells, exfoliates, and melts easily to a white or yellow glass.
Chlorastrolite.	Amorphous.		Fibrous.	3.18	5.5 to 6	Pearly in the fracture.	White.	Bluish green.	Soluble with flocculent silica.	Intumesces and melts to a greenish glass.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Apophyllite,	Right Square Prism.	Very easy parallel to the base.	Conchoidal or uneven.	2.35 to 2.39	4.5 to 5	Vitreous, pearly on the base.	White.	Colorless, gray, yellow, blue, rose, pale green.	Soluble, leaving ~~pulverulent~~ silica. slimy	Exfoliates, intumesces, and melts to a white enamel.
Natrolite,	Right Rhomb. Prism of 91°	Easy parallel to the Prism.	Uneven or conchoidal.	2.1 to 2.2	5 to 5.5	Vitreous.	Colorless.	Colorless, white, gray, red or green.	Soluble with gelatinous silica.	~~Swells~~ and melts to a colorless or greenish glass.
Analcite,	Cube.	Imperfect parallel to the faces of the Cube.	Uneven or conchoidal.	2.2	5.5	Vitreous or pearly.	White.	Colorless, white, gray, blue, green, red.	Soluble with separation of ~~gelatinous~~ or ~~flocculent~~ slimy silica.	~~Swells and melts~~ to a transparent glass.
Chabazite,	Rhombohedron of 94° 46′	Parallel to the Rhombohedron.	Uneven.	2 to 2.1	4 to 4.5	Vitreous	White.	Colorless, white, red, yellow.	Soluble with separation of gelatinous or ~~flocculent~~ slimy silica.	Intumesces and melts to white glass.
Harmotome,	Inclined Rhombic Prism of 124° 47′	Parallel to the base and the Prism.	Uneven or imperfectly conchoidal.	2.4	4.5	Vitreous.	White.	Colorless, white, gray, brown and red.	Soluble with pulverulent silica.	Becomes friable, and then melts with difficulty on the edges.
Stilbite,	Rt. Rhombic Prism of 94° 16′	Easy parallel to the Macro and Brachy-Pinacoids.	Uneven.	2 to 2.2	3.5 to 4	Vitreous, pearly on the Macro-Pinacoid.	White.	White, red, yellow, brown.	Soluble with pulverulent silica.	Swells and melts easily. to a white enamel
Heulandite,	Inclined Rhombic Prism of 136° 14′	Easy parallel to the Clino-Pinacoid.	Uneven or imperfectly conchoidal.	2.1 to 2.2	3.5 to 4	Vitreous or pearly on the Clino-Pinacoid.	White.	White, gray, yellow, brown red.	Soluble with pulverulent silica.	Swells and melts to a white enamel.
Talc,	Rt. Rhombic Prism near 120° ?	Easy Parallel to the base, difficult paral. to the Prism.	Scaly or earthy.	2.6 to 2.8	1 to 1.5	Pearly on the cleavage planes.	White, or lighter than color.	Blue, green, gray, white.	Partly acted on after long ebullition in concentrated acids.	~~Gives a bright flame.~~ Exfoliates and melts with difficulty on the edges.
Sepiolite,	Compact or earthy.		Earthy.	1.2 to 1.6	2.5	Dull.	White.	White, gray, or reddish.	Soluble.	Becomes black and then white, and melts with difficulty on the edges.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Serpentine,	Rt. Rhombic Prism? Crystals generally pseudomorphs.		Conchoidal or Lamellar.	2.47 to 2.60	3	Resinous.	White.	Green, yellow, red.	In powder dissolves in HCl and $\dddot{\mathrm{S}}$.	~~Becomes white~~ and melts with difficulty on the edges.
Prochlorite	Rhombohedron of 65° 28′	Very easy parallel to the base. Trace parallel to the Prism.	Lamellar.	2.6 to 2.8	2 to 2.5	Vitreous or pearly.	Slightly green.	Green, brown, yellow.	In powder soluble in strong $\dddot{\mathrm{S}}$.	Exfoliates, becomes white, and melts with difficulty to a gray enamel.
Nitre,	Rt. Rhombic Prism of 118° 50′	Parallel to the Prism.	Conchoidal.	1.9	2	Vitreous or resinous.	White.	White,	Soluble in water.	Deflagrates.
Aphthitalite,	Rt. Rhombic Prism of 120° 30′	Difficult parallel to the Prism.	Fibrous or uneven.	1.7	3 to 3.5	Vitreous or resinous.	White.	White, bluish or greenish.	Soluble in water.	Fuses without intumescing.
Soda-Nitre,	Rhombohedron of 106° 33′	Parallel to the Rhombohedron.	Imperfectly conchoidal.	2 to 2.2	1.5 to 2	Vitreous.	White.	White, brown, gray, yellow. Double Refracting.	Deliquesces. Soluble in water.	Deflagrates.
Thenardite,	Rt. Rhombic Prism of 125° 55′	Parallel to the base and the Prism.	Uneven.	2.7	2 to 2.5	Vitreous.	White.	White.	Soluble in water.	Colors the flame yellow and fuses.
Glauberite,	Inclined Rhombic Prism of 83°	Easy Parallel to the base.	Conchoidal.	2.6 to 2.8	2.5 to 3	Vitreous.	White.	Yellow or gray.	Partially dissolved in water. Falls to pieces after long expos're	Decrepitates and melts on to a clear glass.
Mirabilite,	Inclined. Rhombic Prism of 86° 31′	Parallel to the Ortho-Pinacold.	Uneven.	1.4	1.5 to 2.0	Vitreous.	White.	White,	Soluble in water.	Fusible.
Halite,	Cube.	Parallel to the faces of the Cube.	Conchoidal.	2.1 to 2.5	2.5	Vitreous.	White.	Colorless, white, yellow, blue, red, purple.	Soluble in water.	Generally decrepitates and then fuses.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Borax,	Inclined Rhombic Prism of 87°	Parallel to the Ortho-Pinacoid and Prism.	Conchoidal.	1.7	2 to 2.5	Vitreous or resinous.	White.	White, gray, or blue.	Soluble in water.	Swells and melts to a transparent glass.
Natron,	Inclined Rhombic Prism of 76°28′	Parallel to the base.	Earthy.	1.4	1 to 1.5	Vitreous.	White.	White, gray, yellow.	Soluble in water. Effervesces with acids.	Swells and melts.
Mascagnite,	Rt. Rhombic Prism of 107°40′	Parallel to the base and Brachy-Dome.	Earthy or uneven.	1.7	2 to 2.5	Vitreous.	White.	Gray, yellow.	Soluble in water.	If pure volatilizes completely.
Sal-Ammoniac,	Cube.	Parallel to the Octahedron.	Uneven.	1.5	1.5 to 2	Vitreous.	White.	White, gray, or yellow.	Soluble in water.	If pure volatilizes completely.
Barite,	Rt. Rhombic Prism of 101°40′	Perfect Parallel to the base.	Uneven.	4 to 4.8	2.5 to 3.5	Vitreous, resinous, or pearly.	White.	White, yellow, gray, blue, red or brown.	Insoluble.	Decrepitates and is fusible with difficulty on the edges.
Witherite,	Rt. Rhombic Prism of 118°30′	Parallel to the Prism.	Uneven.	4.2 to 4.3	3.5 to 3.7	Vitreous or resinous.	White.	White, yellowish, or grayish.	Soluble with effervescence	Decrepitates and melts to a transparent globule which becomes white on cooling.
Barytocalcite,	Inclined Rhombic Prism of 106°54′	Parallel to the Prism.	Uneven.	3.6	4	Vitreous or resinous.	White.	White, gray, green, yellow	Soluble with effervescence	Infusible, but colors the flame yellowish-green.
Celestite,	Rt. Rhombic Prism of 104°2′	Parallel to the base & Prism.	Imperfectly conchoidal, or uneven.	3.9	3 to 3.5	Vitreous or pearly.	White.	White or faintly bluish or reddish.	Insoluble.	Decrepitates and becomes opaque. Gives Sr. reaction.
Strontianite,	Right Rhombic Prism of 117°19′	Parallel to the Prism.	Uneven.	3.6 to 3.7	3.5 to 4	Vitreous or resinous.	White.	Green, white, gray, yellow, brown.	Soluble with effervescence	Melts on the edges and swells. Gives Sr. reaction.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Anhydrite,	Rt. Rhombic Prism of 102°56′	Parallel to the base and the Macro-Pinacoid.	Uneven.	2.8 to 2.9	3 to 3.5	Vitreous or pearly.	Grayish white.	White, grayish, bluish, reddish.	Slightly soluble in $\dot{H}$.	Whitens, does not exfoliate, becomes covered with a white enamel.
Gypsum,	Inclined Rhombic Prism of 138°28′	Parallel to the Clino-Pinacoid.	Uneven.	2.3	1.5 to 2	Pearly or vitreous.	White.	White, gray, yellow, blue, red, black, brown.	Soluble in 4 to 500 parts of water.	Exfoliates and falls to powder.
Fluorite,	Cube.	Parallel to the Octahedron.	Conchoidal or uneven.	3.1	4	Vitreous.	White.	White, yellow, green, blue, red, brown.	Gives the reaction for Fl. with $\dddot{S}$.	Decrepitates and fuses to a white enamel.
Apatite,	Hexagonal Prism.	Imperfect parallel to the base.	Conchoidal or uneven.	3.25	4.5 to 5	Vitreous or resinous.	White.	Colorless, green, blue, violet, red, gray, brown.	Dissolves slowly in $\overset{\cdot\cdot}{\overset{\cdot\cdot\cdot}{N}}$. & HCl	Fusible on the edges.
Pharmacolite,	Inclined Rhombic Prism of 111°6′	Parallel to the Clino-Pinacoid.	Uneven.	2.6 to 2.7	2 to 2.5	Vitreous.	White.	White, gray, or red.	Soluble in acids. Insoluble in water.	Fuses to a white enamel and gives the odor of As.
Aragonite,	Rt Rhombic Prism of 116°10′	Parallel to the Macro-Pinacoid.	Conchoidal or uneven.	2.9	3.5 to 4	Vitreous or resinous.	White.	Colorless, green, yellow, gray, violet.	Soluble with effervescence	Loses $\ddot{C}$ and falls to powder.
Calcite,	Rhomb. of 105°5′	Parallel to the Rhomb.	Conchoidal.	2.5 to 2.7	2.5 to 3.5	Vitreous or earthy.	White or gray.	White, gray, green, yellow, red, black. Double refracting.	Soluble with effervescence	Infusible. Loses $\ddot{C}$ and becomes incandescent.
Dolomite,	Rhomb. of 106°5′	Parallel to the Rhomb.	Conchoidal or uneven.	2.8 to 2.9	3.5 to 4	Vitreous or pearly.	White or gray.	White, gray, red, green, brown, yellow, black.	Slowly soluble.	Infusible. Loses $\ddot{C}$.
Scheelite,	Right Square Prism.	Parallel to the Octahedron.	Uneven.	6	4.5 to 5	Vitreous or adamantine.	White.	White, yellow, brown.	Soluble, leaving a yellow powder.	In thin splinters fuses on the edges.

Fuses at 2.5 to 3.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Brucite,	Rhombohedron of 82°15′	Parallel to the base.	Uneven.	2.3	1.5	Pearly.	White.	White, gray, blue, green.	Soluble.	Infusible. Becomes opaque and friable.
Epsomite,	Rt. Rhombic Prism of 90°34′	Parallel to the Brachy Pinacoid.	Uneven.	1.7	2.25	Vitreous, silky or earthy.	White.	White.	Soluble in water.	Loses water and fuses.
Boracite,	Cube.	Difficult parallel to the Octahedron.	Conchoidal or uneven.	2.9	7	Vitreous or adamantine.	White.	White, gray, yellow, red, green. Pyroelectric.	Soluble when in powder.	Intumesces and fuses to a glass which is white on cooling.
Magnesite,	Rhombohedron of 107°29′	Parallel to the Rhombohedron.	Conchoidal or flat.	2.8 to 3	3.5 to 4.5	Vitreous or silky.	White.	White, yellow, brown.	Dissolves slowly.	Gives a bright light, loses $\ddot{C}$, and is infusible.
Spinel,	Octahedron.	Parallel to the Octahedron.	Conchoidal.	3.5 to 4.9	8	Vitreous or dull.	White.	Red, blue, green, yellow, gray, white, brown, black.	Insoluble in HCl. Partially soluble in $\dddot{S}$.	Infusible, but changes color.
Corundum,	Hexagonal Prism.	Parallel to the base.	Conchoidal or uneven.	3.9 to 4	9	Vitreous pearly. In twin crystals often opalescent.	White.	Colorless, blue, red, yellow, gray, brown.	Insoluble.	Infusible.
Diaspore,	Rt. Rhombic Prism of 93°52	Parallel to the Macro-Pinacoid.	Uneven.	3.3 to 3.5	6.5 to 7	Vitreous, brilliant or pearly on the cleavage.	White.	Colorless, green, violet, blue, red. Shows Polychroism.	Insoluble.	Infusible.
Aluminite,	Botryoidal.		Earthy.	1.6	1 to 2	Dull earthy.	White.	White.	Soluble.	Fuses with difficulty.
Alunogen,	Inclined Rhombic Prism.		Uneven.	1.6 to 1.8	1.5 to 2	Vitreous or silky.	White.	White, yellow, red.	Soluble in water.	Intumesces and fuses.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Alunite,	Rhombohedron of 89° 10′	Parallel to the base.	Conchoidal or flat.	2.5 to 2.7	3.5 to 4	Vitreous or pearly.	White.	White, gray or red.	Soluble when pulverized.	Decrepitates and is infusible.
Kalinite,	Octahedron.	Parallel to the Octahedron.	Conchoidal or uneven.	1.5 to 1.8	2 to 3	Vitreous.	White.	White or brown.	Soluble in water.	Swells and forms a spongy mass.
Cryolite,	Oblique Rhomboidal Prism.	Parallel to the base.	Uneven.	2.9 to 3	2.5	Vitreous or pearly.	White.	White, red or brown.	Soluble in $\dddot{S}$.	Fuses in the flame of a candle.
Turquois,	Botryoidal and mamelonated.		Conchoidal.	2.6 to 2.8	6	Waxy or dull.	White.	Blue.	Soluble.	Infusible.
Wavellite,	Rt. Rhombic Prism of 126°25′	Parallel to the Prism.	Uneven.	2.3	3.2 to 4	Vitreous, pearly or resinous.	White.	White, yellow, green, gray, brown, black.	With $\dddot{S}$ gives off HFl.	Infusible.
Chrysoberyl,	Rt. Rhombic Prism of 119°46′	Parallel to the Brachy Pinacoid.	Conchoidal or uneven.	3.5 to 3.8	8.5	Vitreous.	White.	Green. Dichroic.	Insoluble.	Infusible.
Iron,	Cube.	Parallel to the Octahedron.	Hackly.	7.3 to 7.8	4.5	Metallic.	Gray.	Gray, malleable. Ductile, Magnetic.	Soluble.	Infusible.
Magnetite,	Cube.	Parallel to the Octahedron.	Subconchoidal.	4.9 to 5.1	5.5 to 6	Metallic.	Black.	Black. Magnetic.	Soluble in hot HCl, but not in $\overset{\cdot\cdot}{\dddot{N}}$.	Fuses with difficulty.
Franklinite,	Octahedron.	Parallel to the Octahedron.	Conchoidal.	5.5 to 6.5	5	Metallic.	Reddish brown.	Black.	Soluble in warm HCl.	Infusible, At a high heat, on charcoal, gives off Zn.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Hematite,	Rhombohedron of 86°10′	Indistinct parallel to the Rhombohedron and base.	Subconchoidal or uneven.	4.5 to 5.3	5 to 6.5	Metallic and splendent.	Bright red, or brownish red.	Steel gray or iron black. Sometimes magnetic.	Soluble when in powder, in HCl.	Infusible. In R.Fl blackens and becomes magnetic.
Goethite,	Rt. Rhombic Prism of 94°52′	Parallel to the Brachy-Pinacoid.	Uneven or conchoidal.	4 to 4.4	5 to 5.5	Vitreous or imperfectly adamantine.	Brownish yellow or ochre yellow.	Yellow, red, or blackish brown.	Soluble in HCl.	Infusible, In R.Fl. Blackens and becomes magnetic.
Limonite,	Stalactitic, botryoidal. mamelonated.		Fibrous or earthy.	3.6 to 4	5 to 5.5	Silky, submetallic and earthy.	Yellowish brown.	Dark brown.	Soluble in warm HCl.	Infusible. In R.Fl. Blackens and becomes magnetic.
Pyrrhotite,	Hexagonal Prism.	Parallel to the base.	Subconchoidal.	4.4 to 4.7	3.5 to 4.5	Metallic.	Dark grayish black.	Bronze yellow and copper red. Slightly magnetic.	Soluble in HCl and deposits S.	Gives off $\ddot{S}$ and leaves a magnetic scoria.
Pyrite,	Cube.	Imperfect parallel to the Cube and Octahedron.	Conchoidal or uneven.	4.8 to 5	6 to 6.5	Metallic and glistening.	Brownish black.	Bronze yellow.	Soluble in $\dddot{N}$, but deposits S.	Gives off $\ddot{S}$ and forms a magnetic globule.
Marcasite,	Rt. Rhombic Prism of 106°2′	Parallel to the Prism.	Uneven.	4.6 to 4.8	6 to 6.5	Metallic.	Grayish or brownish black.	Pale bronze yellow with a green or gray tint.	Soluble in $\dddot{N}$, but deposits S.	Gives off $\ddot{S}$ and forms a magnetic globule.
Melanterite,	Inclined Rhombic Prism of 82°21′	Parallel to the base.	Conchoidal.	1.8	2	Vitreous.	White.	Green or white. Becomes yellow on exposure.	Soluble in water.	Turns black and becomes magnetic.
Copiapite,	Hexagonal Prism.	Parallel to the base.	Earthy.	2.14	1.5	Pearly.	Yellow.	Yellow.	Soluble in water.	Loses color and becomes magnetic.
Vivianite,	Inclined Rhombic Prism of 111°12′	Parallel to the Clino-Pinacoid.	Uneven.	2.6	1.5 to 2	Pearly or vitreous	Bluish white.	Blue or green.	Soluble.	Decrepitates, loses color and becomes magnetic.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness.	Luster.	Streak.	Colors and Physical Propert es.	Action of Acids.	Blowpipe Characters.
Leucopyrite,	Rt. Rhombic Prism of 111°30′	Parallel to the base.	Uneven.	7 to 8.7	5 to 5.5	Metallic.	Grayish black.	Between steel gray and silver white.	Soluble and deposits As.	Gives off $\dddot{\text{As}}$ and becomes magnetic.
Arsenopyrite,	Right Rhombic Prism of 111°53′	Parallel to the Prism.	Uneven.	6 to 6.4	5.5 to 6	Metallic.	Dark grayish black.	Silver white.	Soluble, leaving a residue of S and As.	Gives off $\dddot{\text{As}}$ and becomes magnetic.
Scorodite,	Rt. Rhombic Prism of 98°2′	Imperfect parallel to the Macro-Pinacoid.	Uneven.	3.1 to 3.3	3.5 to 4	Vitreous.	White.	Pale green or brown.	Soluble in HCl.	Gives off $\dddot{\text{As}}$ and becomes magnetic.
Pharmacosiderite,	Cube.	Imperfect parallel to the Cube.	Uneven.	2.9 to 3	2.5	Adamantine.	Green, brown, yellow.	Green, brown, red. Pyro-electric.	Soluble in HCl.	Gives off $\dddot{\text{As}}$, fuses and becomes magnetic.
Arseniosiderite,	Fibrous and concretionary.		Earthy.	3.5	1 to 2	Silky.	Yellowish brown.	Yellow.	Soluble in hot HCl.	Fuses to a black enamel, and gives off $\dddot{\text{As}}$.
Siderite,	Rhombohedron of 107°	Parallel to the Rhombohedron.	Uneven.	3.7 to 3.9	3.5 to 4.5	Vitreous or pearly.	White.	Gray, green, brown, red, white.	Dissolves in hot acids.	Infusible. Blackens and becomes magnetic.
Menaccanite,	Rhombohedron of 86°5′	Parallel to the base.	Conchoidal.	4.5 to 5	5 to 6	Submetallic.	Metallic black to brownish red.	Iron black. Slightly magnetic.	Dissolves slowly and imperfectly.	Infusible.
Chromite,	Cube.		Uneven.	4.3 to 4.5	5.5	Submetallic.	Brown.	Black. Slightly magnetic.	Insoluble.	Infusible.
Columbite,	Rt. Rhombic Prism of 100°40′	Parallel to the Macro-Pinacoid.	Uneven.	5.4 to 6.4	6	Submetallic.	Dark red to black.	Iron or brown black. Often iridescent.	Insoluble.	Infusible.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Wolframite,	Rt. Rhombic Prism of 101°5′	Very easy parallel to the Macro-Pinacoid.	Uneven.	7.1 to 7.5	5 to 5.5	Submetallic.	Dark reddish brown.	Dark brownish, black. Sometimes slightly magnetic.	Decomposed by aqua regia.	Decrepitates and melts with difficulty to a magnetic globule.
Braunite,	Right Square Prism.	Parallel to the Octahedron.	Uneven.	4.7 to 4.8	6 to 6.5	Submetallic.	Dark brownish black.	Dark brownish, black.	With concentrated HCl gives off Cl.	Infusible. Reaction for Mn.
Hausmannite,	Right Square Prism.	Parallel to the base.	Uneven.	4.7	5 to 5.5	Submetallic.	Chestnut brown.	Brownish black.	With concentrated HCl gives off Cl.	Infusible. Reaction for Mn.
Pyrolusite,	Rt. Rhombic Prism of 93°40′	Parallel to the Prism and to Brachy-Pinacoid.	Uneven.	4.8 to 4.9	2 to 2.5	Metallic.	Black.	Iron black, dark steel gray, often bluish.	With concentrated HCl gives off Cl.	Infusible. Reaction for Mn.
Manganite,	Rt. Rhombic Prism of 99°40′	Parallel to the Macro-Pinacoid and the Prism.	Uneven.	4.2 to 4.4	4	Submetallic.	Reddish brown.	Dark steel gray or iron black.	Insoluble in $\overset{:\cdot:}{N}$, in HCl gives off Cl.	Infusible. Reaction for Mn. Yields water.
Psilomelane	Massive and botryoidal.		Uneven.	3.7 to 4.3	5 to 6	Submetallic.	Brownish black and shining.	Iron black or dark steel gray.	Soluble in HCl, and gives off Cl.	Yields water. Reaction for Mn.
Wad,	Reniform and amorphous masses.		Uneven.		0.5 to 6.	Metallic or earthy.	Brown, shining.	Brown to gray.	Gives Cl with HCl.	Infusible. Reaction for Mn.
Alabandite,	Cube.	Parallel to the Cube.	Uneven.	3.9 to 4	3.5 to 4	Submetallic.	Green.	Iron black. Becomes brown on exposure.	Soluble and gives off HS.	Fusible. Reaction for Mn.
Triplite,	Rt. Rhombic Prism.	Three difficult and at right angles to each other.	Conchoidal.	3.4 to 3.8	5 to 5.5	Resinous.	Yellowish gray.	Brown.	Soluble.	Fusible. Reaction for Mn.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Rhodochrosite,	Rhombohedron of 106°51′	Parallel to the Rhombohedron.	Uneven.	3.4 to 3.6	3.5 to 4.5	Vitreous or pearly.	White.	Rose.	Soluble in warm acids with effervescence.	Decrepitates, changes color and is infusible. Reaction for Mn.
Linnæite,	Cube.	Imperfect parallel to the Cube.	Uneven.	4.8 to 5	5.5	Metallic.	Blackish gray.	Pale gray or copper red when tarnished.	Soluble in $\overset{\therefore}{N}$, and deposits S.	Gives off sulphur and fuses. Reaction for Co.
Bieberite,	Inclined Rhombic Prism of 97°35′		Fibrous or earthy.	1.92		Vitreous.	Reddish white.	Flesh and rose red.	Soluble in water.	Loses water and at a high heat gives off $\ddot{S}$. Reaction for Co.
Smaltite,	Cube.	Parallel to the Octahedron.	Granular and uneven.	6.4 to 7	5.5 to 6	Metallic.	Grayish black.	Tin white or steel gray.	Gives a pink solution in $\overset{\therefore}{N}$, and deposits arsenic.	Gives off $\dddot{As}$ and melts to a brittle globule. Reaction for Co.
Cobaltite,	Cube.	Parallel to the Cube.	Uneven or lamellar.	6 to 6.3	5.5	Metallic.	Grayish black.	Silver white, with a violet tint, or gray.	Soluble in warm $\overset{\therefore}{N}$, depositing $\dddot{As}$.	Gives off $\dddot{As}$ and becomes magnetic. Reaction for Co.
Erythrite,	Inclined Rhombic Prism of 111°16′	Parallel to the Clino-Pinacoid.		2.9	1.5 to 2.5	Vitreous or earthy.	Paler than the color.	Peach, crimson, red. Sometimes greenish gray.	Soluble.	Gives off $\dddot{As}$ and fuses. Reaction for Co.
Remingtonite,	Incrustation.		Earthy.			Earthy.	Pale rose.	Rose.	Soluble with effervescence	Reaction for Co.
Millerite,	Rhombohedron of 144°8′	Parallel to the Rhombohedron.	Uneven.	5.2 to 5.6	3 to 3.5	Metallic.	Bright.	Brass or bronze yellow.	Soluble in aqua regia.	Easily fusible to a brittle magnetic globule. Reaction for Ni.
Niccolite,	Hexagonal Prism.		Uneven.	7.3 to 7.6	5 to 5.5	Metallic.	Pale brownish, black.	Copper red.	Gives a green solution with aqua regia.	Fuses with odor of As. Reaction for Ni.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Ullmannite,	Cube.	Parallel to the faces of the Cube.	Granular.	6.2 to 6.5	5 to 5.5	Metallic.	Grayish black.	Steel gray.	Soluble in aqua regia. Gives a green color.	Gives off $\dddot{\mathrm{As}}$ and Sb. Fuses and gives a metallic globule. Reactions for Ni.
Annabergite,	Inclined Rhombic Prism.		Uneven or earthy.	3 to 3.1	2.5 to 3	Silky.	Greenish white.	Apple green.	Soluble in $\dddot{\mathrm{N}}$.	Gives off $\dddot{\mathrm{As}}$ and fuses. Reactions for Ni.
Zaratite,	Incrustation.		Conchoidal.	2.5 to 2.6	3 to 3.2	Vitreous.	Pale emerald green.	Emerald green.	Soluble with effervescence	Gives a metallic globule of Ni.
Zincite,	Hexagonal Prism.	Parallel to the base.	Subconchoidal.	5.4 to 5.8	4 to 4.5	Vitreous.	Orange yellow.	Deep red.	Soluble.	Infusible. Reaction for Zn.
Sphalerite,	Cube.	Parallel to the Rhombic Dodecahedron.	Conchoidal.	3.9 to 4	3.5 to 4	Resinous or adamantine.	White or reddish brown.	White, yellow, brown, black, red, green.	Soluble, and gives off HS.	Infusible. Reaction for Zn.
Goslarite,	Rt. Rhombic Prism of 90°42′	Parallel to the Macro-Pinacoid.	Conchoidal.	1.9 to 2.1	2 to 2.5	Vitreous.	White.	White, reddish, bluish.	Soluble in water.	Intumesces. Reaction for Zn.
Smithsonite,	Rhombohedron of 107°40′	Parallel to the Rhombohedron.	Uneven.	4 to 4.4	5	Vitreous or pearly.	White.	White, gray, green, brown.	Soluble with effervescence	Infusible. Reaction for Zn.
Hydrozincite,	Incrustation.		Fibrous or earthy.	3.5 to 3.6	2 to 2.5	Dull.	Shining.	White, gray, yellow.	Soluble with effervescence	Infusible. Reaction for Zn.
Cassiterite,	Right Square Prism.	Imperfect parallel to the Prism.	Conchoidal or uneven.	6.3 to 7.1	6 to 7	Adamantine.	White, gray, brown.	Brown, black, red, gray, white, yellow.	Insoluble.	Infusible. Reaction for Sn.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Stannite,	Right Square Prism ?		Uneven.	4.3 to 4.5	4	Metallic.	Black.	Steel gray, iron black, bluish, or yellowish.	Soluble in aqua regia, and deposits S.	Gives off $\ddot{S}$ and melts to a scoria.
Rutile,	Right Square Prism.	Parallel to the Prism.	Subconchoidal or uneven.	4.1 to 4.2	6 to 6.5	Metallic, adamantine.	Pale brown.	Yellowish, brown, or red, black.	Insoluble.	Infusible. Reactions for Ti.
Octahedrite	Right Square Prism.	Parallel to the Octahedron and base.	Subconchoidal.	3.8 to 3.9	5.5 to 6	Metallic, adamantine.	Colorless.	Brown, blue, yellow.	Insoluble.	Infusible. Reactions for Ti.
Brookite,	Rt. Rhombic Prism of 99°50′	Parallel to the Prism.	Uneven.	4.1	5.5 to 6	Metallic, adamantine.	Colorless.	Brown, yellow, red, black.	Insoluble.	Infusible. Reactions for Ti.
Lead,	Cube.		Hackly.	11.4	1.5	Metallic.	Shining.	Lead gray.	Soluble in $\overset{\therefore}{N}$.	Fusible.
Minium,	Pulverulent.		Earthy.	4.6	2 to 3		Orange yellow.	Red.	Partly soluble in $\overset{\therefore}{N}$.	Fusible.
Galenite,	Cube.	Parallel to the faces of the Cube.	Subconchoidal or uneven.	7.2 to 7.7	2.5 to 2.7	Metallic.	Lead gray, shining.	Lead gray.	Partly soluble in $\overset{\therefore}{N}$.	Gives off $\ddot{S}$ and fuses.
Bournonite,	Rt. Rhombic Prism of 93°40′	Parallel to the Macro and Brachy Pinacoids.	Conchoidal or uneven.	5.7 to 5.9	2.5 to 3	Metallic.	Steel gray, lead gray, iron black.	Steel gray, lead gray, iron black.	Dissolved in $\overset{\therefore}{N}$, giving a blue solution.	Decrepitates and fuses easily. Gives the reactions for S.Sb. Cu., & Pb.
Anglesite,	Rt. Rhombic Prism of 103°38′	Parallel to the Prism and base.	Conchoidal.	6.2	2.7 to 3	Adamantine.	Colorless.	White, tinged with yellow, blue, green.	Insoluble.	Decrepitates and fuses.
Clausthalite,	Cube.	Parallel to the faces of the Cube.	Granular.	7 to 8.8	2.5 to 3	Metallic.	Darker than the color.	Lead gray, bluish or reddish.	Partly soluble in $\overset{\therefore}{N}$.	Gives the odor of Se., fuses and volatilizes.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Pyromorphite,	Hexagonal Prism.	Parallel to the Prism.	Subconchoidal.	6.5 to 7	3.5 to 4	Resinous.	White or yellowish.	Green, yellow, brown, blue.	Soluble.	Fusible.
Mimetite,	Hexagonal Prism.	Parallel to the faces of the Rhombohedron.	Imperfect or Subconchoidal.	7.1 to 7.2	3.5	Resinous.	White or yellowish.	White, yellow brown.	Soluble.	Gives off $\dddot{\mathrm{As}}$ and fuses.
Cerussite,	Rt. Rhombic Prism of 117°13′	Difficult parallel to the Prism.	Conchoidal.	6.4	3 to 3.5	Adamantine, vitreous or pearly.	Colorless.	White, gray, black, blue, green.	Soluble with effervescence	Decrepitates and fuses.
Crocoite,	Inclined Rhombic Prism of 93°44′	Parallel to the Prism.	Uneven.	5.9 to 6.1	2.5 to 3	Adamantine.	Orange yellow.	Bright red.	Soluble.	Blackens, decrepitates and fuses.
Stolzite,	Right Square Prism.	Difficult parallel to the base.	Conchoidal.	7.8 to 8.1	2.75 to 3	Resinous.	Colorless.	Green, yellow, gray, brown, red.	Soluble in $\overset{\therefore}{\mathrm{N}}$.	Fusible.
Wulfenite,	Right Square Prism.	Parallel to the Octahedron.	Subconchoidal.	6.3 to 6.9	2.7 to 3	Resinous.	White.	Yellow, green, gray, white, brown.	Decomposed.	Decrepitates and Fuses.
Bismuth,	Rhombohedron of 87°40′	Parallel to the base.	Indistinct.	9.7	2 to 2.5	Metallic.	Reddish silver white.	Reddish, silver white.	Soluble.	Volatilizes, leaving a yellow coating.
Bismuthinite,	Rt. Rhombic Prism of 91°30′	Parallel to the Brachy-Pinacoid.	Conchoidal.	6.4 to 6.5	2 to 2.5	Metallic.	Lead gray with a yellowish tarnish.	Lead gray with a yellowish tarnish.	Soluble.	Fuses in the flame of a candle, and is volatilized.
Aikinite,	Rt. Rhombic Prism of 110°		Conchoidal or uneven.	6.1 to 6.8	2 to 2.5	Metallic.	Lead gray with a red tarnish.	Lead gray, with a red tarnish.	Partly soluble.	Gives off $\ddot{\mathrm{S}}$ and volatilizes.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Tetradymite,	Rhombohedron of 81°2′	Parallel to the base.	Uneven.	7.2 to 8.4	1.5 to 2	Metallic.	Steel gray.	Steel gray.	Soluble and deposits S.	Easily fusible.
Arsenic,	Rhombohedron of 85°41′	Parallel to the base.	Uneven or granular.	5.9	3.5	Submetallic.	Tin white.	Tin white, tarnishes to gray.	With $\dddot{N}$, $\dddot{As}$ is deposited.	Volatilizes.
Arsenolite,	Cube.		Conchoidal.	3.6	1.5	Vitreous or silky.	White.	White or yellowish.	Slightly soluble in hot water.	Volatilizes.
Realgar,	Inclined Rhombic Prism of 74°26′	Parallel to the base.	Conchoidal or uneven.	3.4 to 3.6	1.5 to 2	Resinous.	Red.	Red and orange yellow.	~~Partly~~ soluble in ~~aqua regia.~~ Caustic alkalies	Fuses and volatilizes.
Orpiment,	Rt. Rhombic Prism of 100°40′	Parallel to the Brachy-Pinacoid.		3.4	1.5 to 2	Pearly or resinous.	Yellow.	Yellow.	Soluble in aqua regia.	Fuses and volatilizes.
Antimony,	Rhombohedron of 87°35′	Parallel to the base.		6.6 to 6.7	3 to 3.5	Metallic.	Tin white.	Tin white.	Soluble in aqua regia.	Fuses and volatilizes.
Senarmontite,	Octahedron.	Parallel to the Octahedron.	Conchoidal.	5.2 to 5.3	2 to 2.5	Resinous.	White.	Grayish white.	Soluble in HCl.	Fuses and is volatilized.
Valentinite,	Rt. Rhombic Prism of 136°58′	Parallel to the Prism.		5.5	2.5 to 3	Adamantine or pearly.	White.	White, red or brown.	Soluble in aqua regia.	Fuses and is volatilized.
Stibnite,	Right Rhombic Prism of 90°45′	Parallel to the Brachy-Pinacoid.	Subconchoidal.	4.5 to 4.6	2	Metallic.	Lead gray.	Lead gray and blackish. Sometimes iridescent.	Soluble.	Fusible in the flame of a candle.

	Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
[illegible] $O_3 + 2Sb S_3$	Kermesite,	Inclined Rhombic Prism.	Parallel to the base.		4.5 to 4.6	1 to 1.5	Adamantine or metallic.	Brownish red.	Cherry red.	Soluble in HCl.	Fuses and is volatilized.
[illegible]	Uraninite,	Cube.		Conchoidal or uneven.	6.4	5.5	Submetallic.	Brown, green, shining.	Gray, green, brown, black.	Gives a yellow solution with $\overset{:\cdot:}{N}$.	Infusible.
[illegible]	Autunite,	Rt. Rhombic Prism.	Parallel to the base.		3.0 to 3.1	2 to 2.5	Pearly or vitreous.	Yellow.	Sulphur yellow.	Gives a yellow solution with $\overset{:\cdot:}{N}$.	Fusible.
[illegible]	Torbernite,	Rt. Rhombic Prism.	Parallel to the base.		3.5 to 3.6	2 to 2.5	Pearly or vitreous.	Green.	Green.	Gives a yellow solution with $\overset{:\cdot:}{N}$.	Gives off H_2O. Fusible. Reactions for Ur + Cu.
[illegible]	Molybdite,	Inclined Rhombic Prism of 136° 48′		Earthy.		−1	Dull or earthy.	Yellow.	Yellow.	Soluble in HCl.	Fusible.
MoS_2	Molybdenite,	Hexagonal Prism. ?	Parallel to the base.		4.4 to 4.8	1 to 1.5	Metallic.	Lead gray; or greenish on glazed porcelain.	Lead gray.	Soluble in $\overset{:\cdot:}{N}$, leaving a residue.	Infusible.
Cu	Copper,	Cube.		Hackly.	8.9	2.5 to 3	Metallic.	Metallic, shining.	Red.	Soluble.	Fusible.
Cu O	Cuprite,	Octahedron.	Parallel to the faces of the Octahedron.	Conchoidal or uneven.	5.8 to 6	3.5 to 4	Adamantine, earthy.	Brownish red, shining.	Red.	Soluble. w HCl + HNO_3 [illegible]	~~In~~Fusible. [illegible] Cu in R.F.
Cu S	Chalcocite,	Rt. Rhombic Prism of 119°35′	Parallel to the Brachy-Dome.	Conchoidal.	5.5 to 5.8	2.5 to 3	Metallic.	Blackish gray and shining.	Blackish gray and bluish.	Soluble and deposits S.	~~Gives off S and colors the flame blue.~~ F[illegible]

	Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
[illegible]	Bornite,	Cube.	Parallel to the Octahedron.	Conchoidal or uneven.	4.4 to 5	3	Metallic.	Pale grayish, black and shining.	Copper red & pinchbeck brown. Easily tarnishes.	Parly soluble in $\overset{\therefore}{N}$.	Blackens, fuses, and gives a magnetic globule.
[illegible]	Chalcopyrite,	Right Square Prism.	Difficult parallel to the base.	Conchoidal or uneven.	4.1 to 4.3	3.5 to 4	Metallic.	Greenish, black or shining.	Brass yellow.	Soluble.	Fuses to a magnetic globule. Gives reactions for Cu.
[illegible]	Tennantite,	Octahedron.	Difficult parallel to the Rhombic Dodecahedron	Uneven.	4.3 to 4.4	3.5 to 4	Metallic.	Dark, reddish, gray.	Lead gray to iron black.	Soluble.	Decrepitates, gives off $\ddot{A}s$. and $\ddot{S}b$. and becomes magnetic.
[illegible]	Tetrahedrite,	Tetrahedron.	Traces parallel to the Octahedron.	Subconchoidal or uneven	4.5 to 5.1	3 to 4.5	Metallic.	Same as color.	Steel gray to iron black.	Partly soluble.	Gives off $\dddot{A}s$. and $\dddot{S}b$. and fuses to a malleable globule.
[illegible]	Chalcanthite,	Doubly inclined Rhomboidal Prism.	Parallel to the Prism.	Conchoidal.	2.2	2.5	Vitreous.	Colorless.	Sky blue.	Soluble in water.	Loses water, fuses, and gives a malleable globule.
[illegible]	Brochántite	Rt. Rhombic Prism of 104°10′	Parallel to the Macro-Dome.	Conchoidal.	3.8 to 3.9	3.5 to 4	Vitreous.	Paler than color.	Emerald or blackish green.	Soluble.	Fuses and gives a globule of copper.
[illegible] $\dot{H} + 3\dot{C}u\,\dot{H}$	Atacámite,	Rt. Rhombic Prism of 112°20′	Parallel to the Macro-Dome.		4 to 4.3	3 to 3.5	Adamantine or vitreous.	Apple green.	Bright or dark green.	Soluble.	Colors the flame intense bluish-green. Gives off Cl.
[illegible] $\dddot{P} + \dot{H}$	Libéthenite,	Rt. Rhombic Prism of 92°20′	Imperfect.	Subconchoidal or uneven.	3.6 to 3.8	4	Resinous.	Olive green.	Olive or blackish green.	Soluble.	Fusible to a partly malleable globule.
[illegible] $\dddot{P}) + \dot{H}$	Olivenite,	Rt. Rhombic Prism of 92°30′	Parallel to the Prism.	Conchoidal or uneven.	4.1 to 4.4	3	Adamantine or vitreous.	Olive green or brown.	Light to dark green.	Soluble.	Gives fumes of $\overset{\wedge\wedge\wedge}{As}$. and fuses.

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Liroconite,	Inclined Rhombic Prism of 119° 20′	Parallel to the Prism.	Conchoidal or uneven.	2.8 to 2.9	2 to 2.5	Vitreous or resinous.	Sky blue or green.	Sky blue or green.	Soluble.	Loses color, gives off $\ddot{As}$ and fuses.
Malachite,	Inclined Rhombic Prism of 103°42′	Parallel to the base.	Subconchoidal or uneven.	3.7 to 4	3.5 to 4	Adamantine, vitreous or silky.	Light green.	Bright green.	Soluble with effervescence	Gives off water and fuses.
Azurite,	Inclined Rhombic Prism of 99°32′	Parallel to the Brachy-Dome.	Conchoidal.	3.5 to 3.8	3.5 to 4.2	Vitreous or adamantine.	Light blue.	Different shades of blue.	Soluble with effervescence	Gives off water and fuses.
Mercury,	Cube.			13.5	–1	Metallic.		Tin white.	Soluble.	Volatilizes.
Cinnabar,	Rhombohedron of 92°36′	Parallel to the Hexagonal Prism.	Conchoidal or uneven.	8.9	2 to 2.5	Metallic or adamantine.	Scarlet.	Red.	Soluble in aqua regia.	Volatilizes.
Calomel,	Right Square Prism.	Parallel to the Prism.	Conchoidal.	6.4	1 to 2	Adamantine.	White.	Yellowish gray or brown.	Soluble in aqua regia.	Volatilizes.
Silver,	Cube.		Hackly.	10.1 to 11.1	2.5 to 3	Metallic.	Silver white.	Silver white.	Soluble.	Fusible.
Amalgam,	Cube.	Parallel to the Rhombic Dodecahedron	Conchoidal.	10 to 14	3 to 3.5	Metallic.	Silver white.	Silver white.	Soluble.	Gives off Hg. and fuses.
Argentite,	Cube.	Parallel to the Rhombic Dodecahedron	Uneven.	7.1 to 7.3	2 to 2.5	Metallic.	Lead, gray, shining.	Black or lead gray.	Soluble.	Gives off $\ddot{S}$, intumesces and fuses.
Proustite,	Rhombohedron of 107°48′		Conchoidal.	5.4 to 5.5	2 to 2.5	Adamantine.	Red.	Red.	Partly soluble.	Gives off $\dddot{As}$ and fuses.

[illegible]

$\dot{Cu}^2\ddot{C} + \dot{H}$

$2\dot{Cu}\ddot{C} + \dot{Cu}\dot{H}$

Hg

Hg S

[illegible]

Ag

[illegible]

Ag S

[illegible]

Name of the Species.	Primitive Form.	Cleavage.	Fracture.	Specific Gravity.	Hardness.	Luster.	Streak.	Colors and Physical Properties.	Action of Acids.	Blowpipe Characters.
Stephanite,	Rt. Rhombic Prism of 115°39′	Parallel to the Macro-Pinacoid and Prism.	Uneven.	6.2	2 to 2.5	Metallic.	Iron black.	Iron black.	Partly soluble.	Gives off S̈b. and fuses.
Pyrargyrite	Rhombohedron of 108°42′	Parallel to the Rhombohedron.	Conchoidal.	5.7 to 5.9	2 to 2.5	Metallic or adamantine.	Red.	Black or dark red.	Partly soluble.	Gives off S̈b. and fuses.
Polybasite,	Rt. Rhombic Prism.	Parallel to the base.	Uneven.	6.2	2 to 3	Metallic.	Iron black.	Iron black or cherry red.	Soluble.	Decrepitates and fuses.
Cerargyrite	Cube.		Conchoidal or uneven.	5.5	1 to 1.5	Resinous or adamantine.	Shining.	Gray, white, greenish or violet. Malleable.	Insoluble. in NO_5 soluble in NH_4O	Fuses in the flame of a candle.
Bromyrite,	Cube.		Conchoidal or uneven.	5.8 to 6	1 to 2	Splendent.	Shining.	Yellow or green. Malleable.	in ~~Partly~~ soluble. in acids partly sol. in NH_4O	Easily fusible.
Embolite,	Cube.		Conchoidal or uneven.	5.3 to 5.8	1 to 1.5	Resinous or adamantine.	Shining.	Green. Malleable.	in ~~Partly~~ soluble. in acids partly sol. in NH_4O	Easily fusible.
Iodyrite,	Hexagonal Prism.	Parallel to the base.	Conchoidal.	5.5	1 to 1.5	Resinous or adamantine.	Yellow, shining.	Yellow.	Soluble.	Fusible.
Gold,	Cube.		Hackly.	15. to 19.0	2.5 to 3	Metallic.	Gold yellow.	Gold yellow.	Soluble in aqua regia.	Fusible.
Platinum,	Cube.		Hackly.	16 to 19	4 to 4.5	Metallic.	Whitish, steel gray, shining.	Whitish steel gray.	Soluble in aqua regia.	Infusible.
Iridosmine,	Hexagonal Prism.		Uneven.	19 to 21	6 to 7	Metallic.	Tin white.	Tin white.	Insoluble.	Infusible.

$5Ag\,S + Sb^2S^3$

$3Ag\,S + Sb^2S^3$

$9Ag\,S + (Sb,As)^2S^3$

$Ag\,Cl$

$Ag\,Br$

$Ag(Cl,Br)$

$Ag\,I$

Au

Pt

Ir Os

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como estar V. señor?

Friedensville Pa

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DEMCO 38-297

Spodum
Biotite
Hercynite
Hollite
Pectolite
Laumontite

Borytoc
Chammed
Vivianit
Rhodoni
Pharmac
Columb
Gemm